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ORIGINAL ARTICLES

EDITOR OF THE MONTH

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Los Angeles, Calif.

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PHYSICAL MEDICINE AND REHABILITATION **

The following services are approved by the Council on Medical Education and Hospitals, and the American Board of Physical Medicine and Rehabilitation. Residencies in this specialty have been approved without specifying the number of years for which they are accredited. The Board will give appropriate credit for training in these hospitals on an individual basis.

Hospitals, 43 Assistant Residencies and Residencies, 87

Name of Hospital	Location	Chief of Service	Inpatients Treated	Number of Treatments	First Year Residencies Offered*	Total Residencies Offered*	Beginning Salary (Month)
UNITED STATES ARMY							
Letterman Army Hospital★	San Francisco	R. C. Psaki	3,330	74,961	—	—	—
Fitzsimons Army Hospital★	Denver	H. B. Luscombe	19,403	258,913	1	4	—
Army Medical Center★	Washington, D. C.	J. H. Kuitert	6,755	283,458	3	5	—
VETERANS ADMINISTRATION							
Veterans Admin. Hospital★[1]	Long Beach, Calif.	R. N. Nyquist	10,922	195,816	1	2	—
†Veterans Admin. Hospital [1]	Fort Logan, Colo.	F. J. Fricke	907	36,326	—	—	—
Veterans Admin. Hospital[1]	Hines, Ill.	L. B. Newman	5,665	450,711	—	4	—
Veterans Admin. Hospital [1]	Wadsworth, Kans.	L. Blau	3,169	192,760	—	—	—
Veterans Admin. Hospital [1]	Framingham, Mass.	F. Friedland	7,000	210,000	1	3	—
Veterans Admin. Hospital [1]	Jefferson Bks., Mo.	E. H. Weissenb'g	2,215	77,491	1	1	—
Veterans Admin. Hospital [1]	New York City	A. S. Abramson	13,819	214,026	3	9	—
Veterans Admin. Hospital [1]	Cleveland	H. T. Zankel	6,414	81,929	1	1	—
†Veterans Admin. Hospital	Portland, Ore.	E. W. Fowlks	4,954	110,420	1	1	—
†Veterans Admin. Hospital [1]	Aspinwall, Pa.	S. Machover	2,516	106,131	—	1	—
Veterans Admin. Hospital★[1]	Houston, Tex.	B. L. Boynton	1,582	6,894	1	1	—
NONFEDERAL							
Los Angeles County Hospital★[1]	Los Angeles	E. Austin	—	91,836	—	1	165
White Memorial Hospital★	Los Angeles	F. B. Moor	195	—	1	1	120
University of Colorado Medical Center Colorado General Hospital★[1]	Denver	H. L. Dinken	2,580	45,876	1	3	75
State of Connecticut Vet. Home & Hosp.	Rocky Hill, Conn.	—	—	—	3	3	—
Emory University Hospital★	Emory Univ., Ga.	R. L. Bennett	1,719	10,473	1	1	50
Georgia Warm Springs Foundation	Warm Springs, Ga.	R. L. Bennett	973	104,401	1	3	250
Cook County Hospital★[1]	Chicago	D. Kobak	7,501	37,516	—	—	—
Michael Reese Hospital★	Chicago	C. O. Molander	2,254	19,549	1	1	25
Northwestern University Medical Center	Chicago	—	13,590	40,962	—	—	—
Research and Educational Hospitals★[1]	Chicago	H. W. Kendell	5,688	11,749	1	3	55
University of Kansas Medical Center★[1]	Kansas City, Kans.	D. L. Rose	2,456	42,310	1	1	100
Massachusetts General Hospital★	Boston	A. L. Watkins	2,925	31,999	0	9	41.66
University Hospital★	Ann Arbor, Mich.	—	—	—	—	—	—
University of Minnesota Hospital★[1]	Minneapolis	M. Knapp	20,409	29,436	4	4	—
Mayo Foundation	Rochester, Minn.	F. H. Kruseu	—	—	2	6	135
Barnes Hospital★	St. Louis	S. Mead	9,759	9,759	0	1	—
†Bellevue Hosp., Div. III, N. Y. Univ.★[1]	New York City	H. A. Rusk	4,058	116,705	—	7	80
Goldwater Memorial Hospital★	New York City	M. Dacso	733	50,706	1	2	80
Hospital for Joint Diseases★[1]	New York City	J. Weiss	—	94,631	1	1	40
Hospital for Special Surgery	New York City	K. G. Hansson	20,806	40,810	1	1	160
Mount Sinai Hospital★[1]	New York City	W. Bierman	11,942	36,970	1	1	50
New York City Hospital★[1]	New York City	F. K. Safford, Jr.	1,128	41,988	1	1	130
†Presbyterian Hospital★[1]	New York City	W. B. Snow	35,865	103,546	1	1	200
St. Luke's Hospital★[1]	New York City	R. Muller	900	98,954	1	1	60
†Rehabilitation Hospital	W. Haverstraw, N. Y.	M. Hoberman	5,888	408,371	1	1	225
Cleveland Clinic Hospital [1]	Cleveland	W. J. Zeiter	17,062	38,475	1	4	—
Hospital of the University of Pa.★[1]	Philadelphia	G. M. Piersol	1,636	35,639	0	1	—
Philadelphia General Hospital★[1]	Philadelphia	A. A. Martucci	2,627	23,733	1	1	75
Medical College of Virginia—Hosp. Div.★[1]	Richmond, Va.	W. J. Lee	4,575	40,327	—	—	46.50

The star (★) indicates hospital approved for intern training.
The dagger (†) indicates temporary approval.
[1] Residencies open to women.
** Reprinted in part J. A. M. A. 147:440 (September 29) 1951.

APPROVED SCHOOLS OF PHYSICAL THERAPY **

Council on Medical Education and Hospitals of the American Medical Association

Name and Location of School	Medical Director and Technical Director	Entrance Requirements [1]	Duration of Course	Classes Begin	Maximum Enrolment	Tuition	Certificate, Diploma, Degree
Medical Department — U. S. Army							
(Address all inquiries to the Office of the Surgeon General, Department of the Army, Washington 25, D. C.)							
Medical Field Service School, Brooke Army Medical Center, San Antonio, Texas	Charles D. Shields, Lt. Col., M.C. Agnes P. Snyder, Major, WMSC	e	49 wks.	Mar.-Sept.	36	None	Certificate
Fitzsimons Army Hospital, Denver	H. B. Luscombe, Col., M.C.	Affiliated with Medical Field Service School					
Letterman Army Hospital, San Francisco, California	Oiena M. Cole, Maj., WMSC Raoul C. Psaki, Lt. Col., M.C.	Affiliated with the Medical Field Service School					
Walter Reed Army Hospital, Washington, D. C.	Emma Harr, Maj., WMSC J. H. Kuitert, Lt. Col., M.C. Brunetta Kuehlthau, Maj., WMSC	Affiliated with Medical Field Service School					
Nonfederal							
Childrens Hospital, Los Angeles*	S. S. Matthews, M.D. Mrs. Mary J. Dodge	a-b-d	14 mos.	Sept	14	$300	Cert. or Degree
College of Medical Evangelists, Los Angeles*	F. B. Moor, M.D. R. Wm. Berdan	a-b-c	15 mos.	Sept	16	$300	Cert. or Degree
University of Southern California, Los Angeles*	C. L. Lowman, M.D.	a-b-d	14 mos	Sept	16	Univer.	Certificate
University of California School of Medicine, San Francisco*	Charlotte W. Anderson Lucile Eising, M.D. Margery L. Wagner	f d	4 yrs. 12 mos.	FebSept Sept	6 16	Univer. $220[2]	Cert. & Degree Cert. or Degree
Stanford University, Stanford University, Calif.*	W. H. Northway, M.D.	a-d-e	12 mos.	Varies	29	$690	Certificate
University of Colorado Medical Center, Denver*	Lucille Daniels Harold Dinken, M.D.	f a-b-d	4 yrs. 12 mos.	Sept Sept	16 12	$220 qr. $208[2]	Degree Cert. or Degree
Northwestern University Medical School, Chicago	Mary Lawrence E. D. W. Hauser, M.D. Gertrude Beard	a-b-d	12 mos.	Oct	16	$450	Certificate
State University of Iowa College of Medicine, Iowa City*	W. D. Paul, M.D. Olive C. Farr	e	12 mos.	Sept	20	$200	Certificate
University of Kansas Medical Center, Kansas City, Kan.*	D. L. Rose, M.D.	d	12 mos.	FebSept	3	$40[2]	Certificate
Simmons College, Boston	F. J. Kottke, M.D. Ruth G. Monteith	f	4 yrs.	FebSept	9	$40[2]	Degree
Boston University College of Physical Education for Women, Sargent College, Cambridge, Mass.	W. T. Green, M.D. Shirley M. Cogland	a-e	16 mos. 4½ yrs.	Sept Sept	24	College	Diploma Degree
Bouve-Boston School in affiliation with Tufts College, Medford, Mass.	Kenneth Christophe, M.D. Adelaide L. McGarrett	c-d-e-f	1-2-4 yrs.	Sept	30	Univer.	Cert. or Degree
University of Minnesota, Minneapolis*	Howard Moore, M.D. Constance K. Greene	f	4 yrs.	Sept	16	$550	Dipl. & Degree
Mayo Clinic, Rochester, Minn.*	F. J. Kottke, M.D. Ruby Green Overmann	c	2 yrs.	Sept	20	$126	Degree
St. Louis University, Division of Health and Hospital Services, St. Louis*	E. C. Elkins, M.D. Harry Keown	a-b-c	2 yrs.	Sept	38	$260	Certificate
Washington University School of Medicine, St. Louis*	A. J. Kotkis, M.D. Sister Mary Imelda	f	4 yrs.	JanSept	12	$175 Semes.	Degree
Albany Hospital, Albany, N. Y.	Sedgwick Mead, M.D. Beatrice F. Schulz	c	2 yrs.	Sept	16	$450 1st yr.[3] $325 2d yr.[3]	Degree
Columbia University College of Physicians and Surgeons, New York City*	J. W. Ghormley, M.D. Catharine Graham	a-b-d f	12 mos. 4 yrs.	Sept Sept	6	$300 $500	Certificate Degree
New York University School of Education, New York City*	W. B. Snow, M.D. Floy L. Pinkerton	a-c-e	1-2 yrs.	Sept	50	$630 (1 yr.) $1,200 (2 yrs.)	Cert. or Degree
Duke University, Durham, N. C.*	G. G. Deaver, M.D. Elizabeth C. Addoms	a (+1 yr. coll.) b-d	12 mos.	Sept	40	$760	Cert. & Degree
Cleveland Clinic Hospital, Cleveland*	I. D. Baker, M.D. Helen Kaiser	a-b-d	15 mos.	Oct	12	$350	Certificate
D. T. Watson School of Physical Therapy, Leetsdale, Pa.*	Walter J. Zeiter, M.D. Mildred Heap	a-b-c	12 mos.	Oct	12	$200	Diploma
Division of Physical Therapy of the School of Auxiliary Medical Services of the University of Pennsylvania, Philadelphia*	Jessie Wright, M.D. Kathryn Kelley	a-b-d	12 mos.	Oct	25	$300	Diploma
University of Texas School of Medicine, Galveston*	G. M. Piersol, M.D. Dorothy E. Baethke	e f	12 mos. 4 yrs.	FebSept Sept	32 40	$600 $600	Certificate Cert. & Degree
Hermann Hospital, Houston, Texas*	G. W. N. Eggers, M.D. Ruby Decker	a-b-d	12 mos.	Jan	8	$149[2]	Cert. or Degree
Baruch Center of Physical Medicine and Rehabilitation, Medical College of Virginia, Richmond*	O. O. Selke, Jr., M.D. Elizabeth Barkley	a-b-d	12 mos.	Oct	15	$300	Certificate
University of Wisconsin Medical School, Madison*	W. J. Lee, M.D. Susanne Hirt H. D. Bouman, M.D. Margaret A. Kohli	a-b-d f a-b-d f	12 mos. 4 yrs. 12 mos. 4 yrs.	Sept Sept Sept FebSept	52 22 20	$300[2] $60 Semes.[2]	Diploma Degree Certificate Cert. & Degree

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1. Courses are so arranged that any of the entrance requirements will qualify students for training. a = Graduation from accredited school of nursing; b = Graduation from accredited school of physical education; c = Two years of college with science courses; d = Three years of college with science courses; e = Four years of college with science courses; f = High school graduation.

2. Nonresidents charged additional fee.

* Male as well as female students admitted

3. Effective July 1, 1952, tuition will be $262.50 for each of the first three semesters, and $112.50 for the fourth semester, making a total of $900.00 for two years.

RESOLUTION APPROVED

The report of the Council on Medical Education and Hospitals of the American Medical Association was approved by the Advisory Board of Medical Specialties at its business meeting on February 10, 1952. Included in this report was the following Resolution:

"Whereas, An emergency medical call service is of proven value both as a community public service and as a means of good public relations between a physician and his community; and

"Whereas, Participation in such a service is not onerous if many physicians cooperate; and

"Whereas, Every County Medical Society has been asked to operate such an emergency service; therefore be it

"Resolved, That every doctor below the age of 35 years, regardless of his type of practice, be urged to participate in his community's call plans; and be it further

"Resolved, That all national specialty boards be requested by the Secretary of the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings.

"Amendment —

"Resolved, That all national specialty boards be requested by the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings."

STUDIES ON NEUROMUSCULAR DYSFUNCTION: XV

The Role of Central Facilitation in Restoration of Motor Function in Paralysis *

HERMAN KABAT, M.D., Ph.D.
Kabat-Kaiser Institute
VALLEJO, CALIFORNIA

In considering the fundamental aspects of therapeutic exercise for restoration of voluntary motion in patients with paralysis, too little attention is often paid to the paramount role of central mechanisms.[1-2] Once a threshold impulse reaches a group of muscle fibers, the fibers have no choice but to contract. The major determining factors in the response of muscle in voluntary motion reside in the central mechanisms rather than in the muscle itself.

It is well established that the motor unit is the fundamental unit of neuromuscular activity. This consists of the anterior horn cell and its motor nerve fiber, the myoneural junction, and a hundred or more muscle fibers innervated by the single motor nerve fiber. This unit functions "all-or-none." This means that, under ordinary conditions, if the anterior horn cell is stimulated strongly enough to discharge, all the muscle fibers of the motor unit contract maximally. The motor unit either responds to a stimulus as strongly as it can or does not respond at all.[3] The strength of contraction of a muscle, either in voluntary motion or in reflex action, is dependent largely on the number of motor units activated: the stronger the contraction, the larger the proportion of active motor units in the muscle. Another less important factor determining strength of muscular response is the frequency of impulses in the motor nerve.

In treatment of paralysis, activity of the motor units results in therapeutic benefit to the muscle in the form of hypertrophy and to the nervous mechanism in greater ease of impulse transmission. It is reasonable, therefore, to set as the goal of the neuromuscular reeducation program, the excitation of all available motor units of the muscle with each voluntary effort. Each exercise would then have the greatest therapeutic effectiveness, both for the muscle and its nervous mechanism. Once the anterior horn cells fire, the associated muscle fibers of their motor units discharge maximally, as a rule, so that the beneficial effects on the muscle follow automatically. The focus of the program must therefore be maximal excitation of the anterior horn cells through central motor mechanisms.

How can one bring about maximal excitation of the motor units of a muscle with each voluntary effort? Since the function of each motor unit under ordinary conditions is automatic and invariable in a maximal response, the number of excited motor units in a muscle must depend on the bombardment of the anterior horn cells with impulses from the motor mechanisms in the central nervous system. In voluntary motion, the primary discharge is from the motor cortex through the corticospinal tract and the internuncial neurons to the anterior horn cells. However, the response is also influenced to a considerable extent by the level of excitation at synapses on the motor

* Read at the Twenty-ninth Annual Session of the American Congress of Physical Medicine, Denver, Colo., Sept. 8, 1951.

1. Kraus, H.: Principles and Practice of Therapeutic Exercise, Charles C Thomas, Springfield, Ill., 1949.
2. Wakim, K. G.: The Physiologic Aspects of Therapeutic Physical Exercise, J. A. M. A. 142: 100, 1950.
3. Fulton, J. F.: Physiology of the Nervous System, Oxford University Press, New York, 1943.

neurons resulting from proprioceptive and postural reflexes and efferent discharges from the cerebellum, basal ganglia and brain stem. The importance of summation of subthreshold stimuli and of facilitation in the central nervous system in determining the strength of reflex response is well established.[2] A stimulus to the anterior horn cells excites some motor neurons to exceed their threshold and discharge impulses, while many other anterior horn cells reach a level of excitation below threshold and fail to fire. The latter anterior horn cells are the "subliminal fringe."[2] Summation of the subthreshold excitation with stimulation from other sources (facilitation) brings the level of excitation of these neurons up to threshold and enhances the motor response by recruiting additional motor units to activity. Central facilitation is essential for maximal excitation of the motor units in voluntary motion.

For a number of years we have applied a variety of facilitation techniques in treatment of paralysis in order to bring about maximal excitation of the available anterior horn cells.[4-5-6-7-8-9-10] The techniques of central facilitation which we have employed in treatment of paralysis include:

(1) Maximal resistance.
(2) Stretch.
(3) Mass movement patterns.
(4) Reflexes.
(5) Reversal of antagonists.

The therapeutic program has been applied in the treatment of thousands of patients with a variety of types of paralysis at the Kabat-Kaiser Institute without demonstrable harmful effects and with excellent recovery of motor function.[4-5-6-7-8-9-10-11-12]

One might expect that, with the patient exerting the greatest possible effort in voluntary contraction of a muscle against maximal resistance, it would be certain that a maximal response would ensue. This is not true, however, and one can readily demonstrate a considerably greater motor response from employing facilitation mechanisms in addition to resistance. This phenomenon can be demonstrated most strikingly in the response of "zero" muscles. In many cases of poliomyelitis as well as in patients with upper motor neuron lesions, we have found muscles which failed to give any response on voluntary effort in free motion and which also failed to give any response when an attempt was made to contract the isolated muscle against maximal resistance. This "zero" muscle, however, showed a definite response when other facilitating mechanisms were employed and summated to bring about greater excitation. For example: A peroneal muscle which failed to respond at all in attempted isolated free motion or against resistance, definitely contracted with the application of stretch and voluntary effort in a mass movement pattern of extension and abduction of the hip against resistance.[5-7-9] In the example of such a "zero" muscle, there can be no question that facilita-

4. Kabat, H.: Studies on Neuromuscular Dysfunction, X: Treatment of Chronic Multiple Sclerosis with Neostigmine and Intensive Muscle Re-education, Permanente Foundation Med Bull. 5:1 (Mar.) 1947.
5. Kabat, H.: Studies on Neuromuscular Dysfunction, XI: New Principles of Neuromuscular Re-education, Permanente Foundation Med. Bull. 5:111 (Nov.) 1947.
6. Kabat, H.: Studies on Neuromuscular Dysfunction, XII: Rhythmic Stabilization; a new and More Effective Technique for Treatment of Paralysis Through a Cerebellar Mechanism, Permanente Foundation Med. Bull. 8:9 (Jan.) 1950.
7. Kabat, H.: Studies on Neuromuscular Dysfunction, XIII: New Concepts and Techniques of Neuromuscular Reeducation for Paralysis, Permanente Foundation Med. Bull. 8:121 (July) 1950.
8. Kabat, H.: Studies on Neuromuscular Dysfunction, XIV: Restoration of Voluntary Motion and Sensation Through Neuromuscular Reeducation in Apparently Complete Traumatic Paraplegia, Permanente Foundation Med. Bull. 9:186 (July) 1951.
9. Kabat, H.: Central Mechanisms for Recovery of Neuromuscular Function, Science, 112:23 (July 7) 1950.
10. Kabat, H., and Rosenberg, D.: Concepts and Techniques of Occupational Therapy for Neuromuscular Disorders, Am. J. Occup. Therapy 4:6 (Jan.-Feb.) 1950.
11. Cailliet, R.: The Rehabilitation Treatment of Multiple Sclerosis and Its Rationale, Occup. Therapy 29:1 (Feb.) 1950.
12. Huddleston, O. L.: Use of an Intensive Physical Medicine Program in the Rehabilitation of Convalescent and Chronic Anterior Poliomyelitis Patients, Arch. Phys. Med., 1952 (in press).

tion was essential to bring about a response by raising the level of excitation above threshold for the anterior horn cells, since no response at all occurred with a lower level of facilitation of these dormant motor neurons, despite the greatest effort on the part of the patient. An increased response above that obtained by resistance alone can also be demonstrated from application of additional facilitating mechanisms in muscles only partially paralyzed and even in normal muscles.

Strong confirmatory evidence for the importance of central facilitation in increasing motor unit activity in voluntary motion is presented in the experimental work of Gellhorn.[13] He demonstrated the powerful effect of proprioceptive facilitation through resistance, stretch and mass movement patterns in increasing the number of motor units in the muscle excited by electrical stimulation of the motor cortex in the monkey. In a chapter in his forthcoming book,[13] Gellhorn points out that such techniques of central facilitation are essential for an effective program of neuromuscular reeducation for paralysis.

Hellebrandt, et al.[14] demonstrated a significant effect of central facilitation in normal subjects in increasing work capacity and decreasing fatigue. The wrist extensors were contracted rhythmically against resistance in ergographic experiments. The work capacity of the right wrist extensors was definitely greater when the muscles were exercised bilaterally than when they were exercised unilaterally. Augmentation in work output was greatest when the exercise was performed by alternately contracting the right and left wrist extensors. The bilateral exercise not only increased the immediate response but was effective in overcoming fatigue from unilateral exercise. It was shown that active recuperation, accompanied by central facilitation, was more effective in eliminating fatigue than was passive recuperation.

The most important fundamental work on central facilitation in motor mechanisms was carried out by Sherrington and his co-workers.[3] In a striking experiment on monkeys, Mott and Sherrington[15] demonstrated that elimination of proprioception from a limb by deafferentation results in complete and permanent paralysis of voluntary motion of that limb. Since voluntary motion is practically impossible after deafferentation of a limb, although the response to cortical stimulation is relatively unimpaired, proprioceptive impulses must be considered the essential afferent arc in performance of voluntary motion. Sherrington also demonstrated the principle of successive induction,[3] showing that immediately after excitation of the antagonist muscle, the agonist was facilitated. This principle has been applied in our facilitation technique of reversal of antagonists.

The usual procedure in treatment of paralysis is to follow a routine of physical therapy starting with passive motion and progressing gradually through assistive motion, free motion with gravity eliminated, and free motion against gravity to resistive technique.[1] Emphasis is placed on avoidance of fatigue and prevention of stretch of the affected muscles. This procedure is applied in voluntary contraction of isolated single muscles or single motions with rigid exclusion of activity of other muscles.[1] These techniques have until recently been accepted without question as the most effective approach to neuromuscular reeducation. Some investigators have advocated

13. Gellhorn, E.: Restitution of Movement After Central Lesions, Oxford University Press (Chapter in book in press).
14. Hellebrandt, F. A.; Houtz, S. J., and Eubank, R. N.: Influence of Alternate and Reciprocal Exercise on Work Capacity, Arch. Phys. Med. 32:766 (Dec.) 1951.
15. Mott, F. W., and Sherrington, C. S.: Experiments Upon the Influence of Sensory Nerves Upon Movement and Nutrition of the Limbs, Proc. Roy. Soc. 57:481, 1895.

earlier and more intensive use of resistive exercise and these procedures are becoming more widely accepted.[16-17] However, no thorough theoretical analysis of the effectiveness of resistance has been presented by these investigators.

The generally accepted program of neuromuscular reeducation places great emphasis on avoidance of excessive activity, with much of the time spent in passive and assistive exercise and with concentration on avoidance of fatigue. This technique fails to activate all of the available motor units of the muscle and is therefore not fully effective in the therapy of paralysis. Electromyographic studies of normal and paralyzed muscles reveal a marked increase in the number of active motor units in the muscle when voluntary contraction takes place against resistance as compared to assistive motion or even free motion against gravity.[13] Some muscles hardly respond at all until resistance is applied.[18] Without denying the importance of passive motion as a therapeutic measure to increase range of joint motion, it must be recognized that passive motion accomplishes nothing directly in improving function of paralyzed muscles, since no voluntary activity is induced in the motor units. In assistive motion, only a small percentage of all the motor units of the muscle is active in a single effort. Since the activity of the motor units is responsible for the therapeutic effect of the exercise, what conceivable advantage can there be in keeping the majority of the motor units in the muscle inactive in such a therapeutic program? It is evident that one is not sparing the muscle from excessive activity by using assistive motion, since all of the active motor units contract maximally (all-or-none). The inactive motor units are not responding at all and are therefore not receiving treatment. Furthermore, repetition of assistive motion would activate the same small group of motor units each time, since these are the units which have the lowest threshold of excitation. Even free motion with gravity eliminated and, in many instances, free motion against gravity excite a relatively small proportion of the motor units in the muscle. Only after application of maximal resistance do a large proportion of the motor units respond.

In our therapeutic program based on central facilitation, we have discarded many of the features of the accepted routine procedure in treatment of paralysis. Instead of progressing gradually through passive and assistive motion and free motion to resistance, we routinely apply maximal resistance from the beginning. Instead of attempting to avoid stretch of the paralyzed muscles in the neuromuscular reeducation program, we utilize stretch as an effective facilitation technique. Instead of meticulously reeducating isolated muscles we routinely apply therapy in mass movement patterns for greater facilitation. Instead of excessive concern to avoid fatigue we carry out an intensive program of maximal activity through a large part of each day and thereby develop greater endurance. We also utilize central facilitation or "active recuperation" [14] as a mechanism for decreasing central fatigue.

Our routine program of manual resistive exercise for treatment of paralysis is based on summation of a number of facilitation techniques in each exercise. In this way, the greatest possible facilitation is achieved with each voluntary effort of the patient. In addition to resistance, a mass movement pattern or combination of mass movement patterns and one of the techniques of reversal of antagonists are used routinely. Quite commonly, stretch and a

16. DeLorme, T. L., and Watkins, A. L.: Progressive Resistance Exercise — Technique and Medical Application, Appleton Century Crofts, Inc., New York, 1951.
17. Gurewitsch, A. D.: Intensive Graduated Exercises in Early Infantile Paralysis, Arch. Phys. Med. 31:213 (April) 1950.
18. Levine, M., and Kabat, H.. Proprioceptive Facilitation of Voluntary Motion in Man, J. Nerv. & Ment. Dis. (in press).

suitable reflex are added to improve the response in the exercise. It is important to note that these techniques require a great deal of special training, skill and experience, both for the doctor prescribing them and for the therapist who follows the prescription.

Facilitation Techniques

1. *Resistance.* — It is well established that resistance increases the response of muscles in voluntary contraction. This observation is common knowledge to weight lifters who use maximal resistance to build up muscle power and bring about hypertrophy. While resistive exercise through the use of weights is not new, DeLorme and Watkins have made a significant contribution in placing emphasis upon it as a treatment procedure.[16] The use of weights, pulleys, friction, anti-gravity exercises and similar techniques are valuable as methods of applying resistance and are used routinely in our treatment program.[7] Resistive exercise is also prescribed in occupational therapy.[18] On the other hand, we have found that manual resistance allows the greatest range of technical procedures for facilitation and is essential for effective treatment of paralysis.

The greatest flexibility in application of resistive exercise is afforded by individual treatment by a skilled physical therapist. The therapist can combine a variety of powerful facilitating techniques with resistance in order to obtain a greater response in voluntary contraction of weakened, paralyzed, and even "zero" muscles. Resistance can be varied through the range of motion exactly as needed to maintain a maximal contraction throughout the range. The therapist can also assist the patient to increase active range of motion by taking the joint beyond his active range and having him make a facilitated maximal isometric contraction. Manual resistance is also essential for guidance of the voluntary motion in the proper direction and elimination of substitution In addition to application of resistance for fundamental neuromuscular reeducation, the therapist can also accelerate training of essential patterns such as sitting balance, standing balance, and balance on crutches by applying resistance in these more complex patterns. A close personal relationship is also developed between the patient and the therapist in the daily treatment periods and for this reason the therapist can elicit greater effort, concentration and cooperation.

While the effect of resistance in increasing the response of muscles in voluntary contraction is widely known and accepted without question, the physiologic mechanism involved has received little attention. In their recent book on progressive resistance exercise, DeLorme and Watkins[16] merely mention that resistance induces proprioceptive stimulation and present no thorough discussion of the fundamental physiologic mechanism of resistance.

Recently, experiments in monkeys by Gellhorn[19] have thrown considerable light on the mechanism of resistance. He was able to show that when a point on the motor cortex was stimulated to produce contraction in a particular muscle, the strength of the response was relatively slight when the joint was allowed to move freely as compared to the response obtained when the joint was fixed. Fixation of the joint in his experiments constituted resistance and he demonstrated that the mechanism of resistance was through proprioceptive stimulation by the increased tension in the muscle. Although a subthreshold electrical stimulus to the motor cortex point failed to bring

19. Gellhorn, E.: Proprioception and the Motor Cortex, Brain 72:35, 1949.

about any discharge when the joint was allowed to move freely, the same stimulus elicited a contraction in the muscle when resistance and stretch were applied. He demonstrated in this way that the cortical stimulus which was too weak to excite an impulse by itself could summate with proprioceptive stimulation from the muscle to raise the level of excitation above threshold. To quote his paper:[20] "The effects seem to be based on the interaction of the proprioceptive impulses with those elicited by cortical stimulation, resulting in an increased number of discharging motor units."

Further evidence that the proprioceptive impulses from the muscle are responsible for the facilitation of the response to cortical stimulation is the fact that the facilitation effect is eliminated by deafferentation of the limb.[20]

Another factor in the increased response of the muscle against resistance is related to the muscle itself rather than the nervous mechanism. Even in the isolated nerve-muscle preparation on supra-maximal nerve stimulation, increased length or increased load enhances the mechanical response of the muscle but not the electromyogram.[21] In voluntary motion or cortical stimulation, proprioceptive facilitation, resulting in a greater number of functioning motor units, is a much more important factor in the increased muscular contraction resulting from resistance and stretch than is the direct effect on the muscle itself.[21]

2. *Stretch.* — In many patients with paralysis, resistance applied to the shortened muscle may be relatively ineffective while resistance applied to the stretched muscle elicits a stronger response.[5-6-7-9] This is especially true in flaccid paralysis, as in poliomyelitis. Rapid stretch is particularly effective in producing facilitation in such techniques as sudden breaking of a hold followed immediately by active motion against resistance. Another method of quick stretch of the muscles is holding, relaxing, then active motion in rapid sequence.

Not only is stretching effective in facilitating contraction in the stretched muscle, but stretch of another muscle which is part of the same mass movement pattern can also produce facilitation of a paralyzed muscle.[7-9] For example: voluntary contraction of the iliopsoas muscle can be facilitated, not only by stretching of the iliopsoas but also by stretch of the anterior tibial muscle, which is associated with the iliopsoas in a total flexion pattern of the lower extremity.

Stretch of an antagonist, particularly if that muscle is spastic, may inhibit both range of motion and facilitation of voluntary contraction of the agonist muscle. Use of a position in which stretch of the antagonist is avoided will allow greater facilitation of the agonist. As an example: contraction of the anterior tibial muscle may be minimal while the patient is supine with the knee extended; yet the same muscle will contract with considerable strength against resistance with the hip and knee flexed.[5-6] In the more favorable position, stretch of the spastic gastrocnemius is effectively reduced.

On the other hand, stretch of the antagonist may in some instances apparently stimulate a better response of the agonist. We have noted particularly in athetosis that the voluntary contraction in the shortened range of the muscle against resistance is usually greater than in the lengthened range.[5-6]

20. Hyde, J., and Gellhorn, E.: Influence of Deafferentation on Stimulation of Motor Cortex, Am. J. Physiol 160:311, 1949.
21. Loofbourrow, G. N.: Electrographic Evaluation of Mechanical Response in Mammalian Skeletal Muscle in Different Conditions, J. Neurophysiol. 11:153, 1948.

Gellhorn[19] demonstrated in the monkey that stretch of a muscle added to resistance further facilitates the response of this muscle to electrical stimulation of the proper cortical focus. Resistance is a more powerful facilitation mechanism than stretch. The combination of stretch and resistance greatly increases the recruitment of anterior horn cells in response to weak stimulation of the motor cortex: "The magnitude of the intensification is considerable since subthreshold cortical stimulation may be made effective by bringing proprioceptive impulses into play, whereas often even a considerable increase in stimulus intensity fails to cause the same motor effect in the absence of such facilitatory proprioceptive impulses."[19] Gellhorn also showed that stretch of a synergistic muscle in the mass movement pattern also has a facilitating effect on the response of the prime mover to cortical stimulation.

3. *Mass Movement Patterns.* — In the usual routine of treatment of paralysis, great emphasis has been placed on contraction of isolated muscles or performance of single elementary motions such as flexion of the elbow or extension of the wrist.[1] This is believed to be the best method of developing voluntary control through neuromuscular reeducation. By concentrating the patient's attention and effort on a single muscle or elementary motion it is felt that more effective recovery from paralysis results.

For a number of years, we have been convinced that the procedure of treatment of isolated muscles or isolated motions is relatively ineffective and unsound. A single muscle or an isolated individual motion is practically never used in the performance of voluntary activities. Furthermore, powerful facilitation of the voluntary response of a paralyzed muscle can be brought about through performance of a mass movement pattern of an entire extremity against resistance.[5-6-7-8-9] In a particular patient, the anterior tibial muscle which fails to respond at all in free motion or against resistance in an isolated motion, definitely contracts when the patient performs a mass flexion pattern of the entire lower extremity against maximal resistance. This facilitation occurs only if the hip and knee flexors respond with sufficient power to overflow innervation to the paralyzed anterior tibial. However, if the hip and knee flexors were also severely paralyzed, facilitation of the anterior tibial muscle from this procedure would not ensue. The mechanism of overflow of excitation to a paralyzed muscle in a mass movement pattern is apparently similar to irradiation in reflexes.[5]

The facilitation in a mass movement pattern can occur not only through overflow from functioning proximal muscles to paralyzed distal muscles in the extremity but also in the reverse direction. A relatively strong anterior tibial muscle can facilitate a paralyzed iliopsoas muscle when the mass flexion pattern is performed against maximal resistance. As mentioned previously, stretch of synergistic muscles in a mass movement pattern is also an effective facilitation mechanism. Because of the great value of the facilitation produced by mass movement patterns, we have to a large extent discarded exercise of individual motions and routinely use mass movement patterns in the therapy of paralysis.[5-6-7-8-9]

Primitive complex patterns of motion are used routinely in normal activities requiring great effort in work and sports. Examples include: chopping wood, running, using a shovel, throwing a ball, swimming, and pulling up weeds. Careful analysis of these motions reveals that the direction of the motion is not straight, but is diagonal and spiral. This probably corresponds to the anatomical distribution of the muscles in the pattern for the application of the greatest power. We have found that diagonal, spiral mass movement

patterns are usually more effective in facilitation than are straight mass movement patterns.[7-9] For example, greater facilitation of a paralyzed peroneal muscle can be achieved by overflow from a diagonal spiral pattern of extension, abduction, internal rotation of the hip against resistance, than from a pattern of straight abduction of the hip. An example of a diagonal mass movement pattern of the upper trunk is: flexion, lateral motion and rotation of the neck and upper trunk to the right, with extension, adduction, internal rotation of the left shoulder. This is a motion of rolling over to the right from the supine position, in an adversive movement. A diagonal spiral pattern of the lower extremity is: flexion, adduction, external rotation of the hip; flexion of the knee; dorsiflexion, inversion of the ankle and extension of the toes. An example of the upper extremity is: flexion, abduction, external rotation of the shoulder; extension of the elbow, supination; radial extension of the wrist and opening of the hand.

Frequently, a combination of mass movement patterns produces greater facilitation.[5-9-7] If the left hip flexors are much stronger than the right, the affected right hip flexors will show a stronger response from bilateral symmetrical mass flexion patterns of the lower extremities than from flexion of the right leg alone. In this way, bilateral symmetrical, asymmetrical and reciprocal mass movement patterns of upper or lower extremities may be effective in facilitation. The response of a paralyzed muscle in the lower extremity may also be augmented by a combination of mass movement patterns of the leg with the stronger opposite arm in a primitive running pattern.

Instead of treating severely paralyzed and "zero" muscles in the usual way with assistive isolated motion yielding little or no response, such muscles are treated in our program routinely against resistance with a variety of facilitation techniques including overflow from less involved muscles in a mass movement pattern or combination of patterns. Whereas the usual physical therapy program is devoted almost exclusively to the more involved muscles, our facilitation program devotes much attention to the less involved muscle groups as well. But in this process, rather than neglecting the more severely paralyzed muscle groups, these muscles recover function much more rapidly because their response is facilitated. Also, coordinated patterns which can carry over directly into practical activities are developed more effectively. Another significant advantage of mass movement patterns is that a large number of muscles is exercised at one time so that the therapist can accomplish much more in each treatment period than when isolated individual motions are performed.

Mass movement patterns are prescribed not only in manual resistive exercise in daily individual physical therapy periods, but are also applied in the gymnasium. Mass movement patterns and combinations are carried out against the resistance of pulleys, dumbbells or weighted boots. Primitive natural patterns are also applied in mat work in activities such as crawling, rolling over, sitting up and anti-gravity exercises.[22] Resistive exercise in mass movement patterns has also proved useful in many cases in occupational therapy.

From extensive observations on a large number of patients with neuromuscular disorders, it is apparent that even in those with severe paralysis from various lesions, such as of the corticospinal tracts, anterior horn cells, or cerebellum, the mass movement patterns are still relatively undisturbed.

22. Haller, J. S., and Gurewitsch, A. D.: An Approach to Dynamic Posture Based on Primitive Motion Patterns. Arch. Phys. Med. 31:632, 1950.

The patterns are also demonstrable in patients with Parkinson's disease. Of all types of paralysis studied, the only patients who showed disruption and disturbance of the mass movement patterns were those with athetosis.[7] Since patients with athetosis have disturbed patterns but patients with Parkinson's disease do not, only part of the basal ganglia, presumably the neostriatum, appears to be directly related to the mechanism of mass movement patterns.

Inman, Saunders, and Abbott[23] were impressed by the importance of patterns of motion for muscle reeducation, they state: "There is, for example, no such thing as a prime mover, as ordinarily understood. There are only patterns of action. This conception extends and amplifies the axiom laid down by Beevor when he said with regard to the brain that it knows nothing of the action of the individual muscles, but only of movement. . . . Sampling of various portions of an individual muscle shows that they can act independently, but synchronously in association with the total pattern of a specific movement. This great principle is absolutely fundamental for establishing rational procedures of muscle re-education. These patterns of muscular activity cannot be reduplicated by voluntary contraction of the muscle alone. They can only be brought into play by carrying out the precise motion itself, which probably brings into play proprioceptive mechanisms. . . . Motion, and motion alone, is the only known stimulus able to engender, in phase and degree, the muscle activity requisite for the establishment of the pattern as a whole."

Gellhorn presents conclusive evidence that mass movement patterns are excited by electrical stimulation of a single point on the motor cortex. In a recent paper,[24] he stated: "Stimulation of the motor cortex in anesthetized monkeys (Macacus rhesus) under threshold conditions . . . . shows that not single muscles or parts of muscles are activated, but muscle groups which are functionally interrelated. Such grouped muscle activity which seems to be the basis of coordinated movement is induced in a similar manner from all parts of the motor cortex on threshold stimulation. No essential differences were found between areas 4 and 6 in this respect." In others words, the response to very weak electrical stimulation of an individual focus in the motor cortex is in a synergistic pattern of muscles at more than one joint, rather than a single muscle or single motion. In another paper,[19] Gellhorn demonstrated that proprioceptive impulses induced by resistance and stretch become effective in facilitating the response to cortical stimulation not only in the stretched and resisted muscle but throughout the mass movement pattern, he states: "In addition, proprioceptive impulses thus induced become effective, although to a lesser extent, in those muscles with which the proprioceptively excited muscle forms specific functional associations. . . . For instance, proprioception originating in the biceps increases also the reactivity of the extensor carpi to cortical stimulation; similar relations exist between triceps and hamstrings; hamstrings and anterior tibial muscle. It was shown also that this effect occurs in the opposite direction within these complexes. For example, fixation of the wrist in ventroflexion increases the reactivity to cortical stimulation not only of the extensor carpi but also of the biceps muscle."

In a more recent paper, Gellhorn and Johnson[25] observed that stimulation of an individual focus of the motor cortex in the monkey excites a highly

23. Inman, V. T.; Saunders, J. B., and Abbott, L. C.: Observations on the Function of the Shoulder Joint, J. Bone & Joint Surg. 26:1, 1944.
24. Gellhorn, E.: Validity of the Concept of Multiplicity of Representation in the Motor Cortex Under Conditions of Threshold Stimulation, Brain 73:267, 1950.
25. Gellhorn, E., and Johnson, D. A.: Further Studies on the Role of Proprioception in Cortically Induced Movements of the Foreleg in the Monkey, Brain 73:513, 1950.

specific mass movement pattern of the entire limb. In these experiments, the patterns of the fore-limb were investigated more thoroughly, they write: "The biceps complex was found to consist largely of the flexors of the elbow, the extensors of wrist and fingers and acromio-deltoid muscle, while the triceps complex comprised, in addition to the extensors of the elbow, the flexors of the wrist and fingers and most of the shoulder muscles with the exception of the acromiodeltoid muscle." These patterns were facilitated by proprioceptive stimulation through stretch and resistance.

Our observations on facilitation of voluntary motion in patients with paralysis were made independently of Gellhorn's experiments on facilitation of the response to electrical stimulation of the motor cortex in monkeys. It is apparent, however, that the demonstrated facilitation mechanisms are essentially similar in the monkey and in man. The striking facilitation effect induced by stretch and resistance in patients is identical in the monkey experiments.[10] The specific synergistic patterns of an entire limb as demonstrated in the fore-limb of the monkey through electrical stimulation of the motor cortex[25] are similar to the mass movement patterns which we have found useful as a powerful facilitation mechanism for the upper extremity in patients. Both Gellhorn's experiments and our observations confirm the fact that the mass movement patterns are equally effective in a distal-to-proximal as in a proximal-to-distal direction.

4. *Reflexes.* — A number of reflexes can be utilized as facilitation techniques. The procedure is to stimulate the reflex and perform voluntary motion against resistance in the same muscle group simultaneously, using the reflex excitation to facilitate the voluntary neuromuscular response.[5-6-7-9] The reflex stimulus must be weak enough so that the voluntary component of the response is as great as possible. The reflex may be stimulated continuously while the voluntary component is alternately contracted and relaxed. Also, the period of after-discharge of the reflex may be utilized in combination with voluntary motion against resistance.

Besides the simple stretch reflexes discussed above, other proprioceptive reflexes are of value as facilitation techniques in treatment of paralysis. These include the postural and righting reflexes such as the tonic neck reflexes of Magnus and vestibular reflexes.[5-6-7-9] Another example is the positive supporting reaction which is the extensor thrust elicited by pressure stimulation on the plantar surface of the foot.[6] In carrying out therapy for sitting balance, kneeling balance, and standing balance against resistance, large complex patterns of muscular response are excited with facilitation from postural and righting reflexes. Other reflexes which can facilitate voluntary effort to increase contraction in paralyzed muscles include the mass flexion reflex of the lower extremity (von Bechterew reflex), and gag reflex.[5-6-7-9]

Loofbourrow and Gellhorn[26] demonstrated that activity in the same functional associations of muscle groups in patterns is induced by stimulation of stretch reflexes of the muscles as is produced by electrical stimulation of the motor cortex. From this they reason that the same mechanism may play a role in voluntary motion and in simple proprioceptive reflexes. In another paper,[27] the same authors showed that reflexes produced by electrical stimulation of afferent nerves brought about responses in the identical patterns of specific synergistic muscle groups. The motor responses in the patterns in

26. Loofbourrow, G. N., and Gellhorn, E.: Proprioceptively Induced Reflex Patterns, Am. J. Physiol. 154:423, 1948.
27. Loofbourrow, G. N., and Gellhorn, E.: Proprioceptive Modification of Reflex Patterns, J. Neurophysiol. 12:435, 1949.

these reflexes were facilitated by stretch and resistance in a manner similar to the proprioceptive facilitation observed in experiments on cortical stimulation.

5. *Reversal of Antagonists.* — In the performance of many activities in work and sports, the antagonist motion is carried out immediately preceding the main action. For example: in pitching a baseball, the arm is first brought back, the trunk rotated and the opposite leg raised and then, in a continuous sequence without interruption, the ball is thrown. The antagonist motion precedes the action in chopping wood, the golf swing, kicking a football, using a scythe and many other activities. The contraction of the antagonist against resistance immediately preceding resistive exercise of the agonist is a valuable technique of facilitation.[6-7-9] The stronger the contraction of the antagonist, the greater is the facilitation of the agonist muscle. This technique is particularly effective when the agonist is paralyzed and the antagonist is relatively uninvolved. Reversal of antagonists is usually applied in mass movement patterns against maximal resistance and can be summated with other facilitation techniques. Frequently, repeated reversal of antagonists builds up greater facilitation, and is followed by repeated resistive exercise of the agonist pattern. When fatigue of the agonist pattern sets in, another reversal of antagonists helps to overcome the fatigue and restore effective facilitation.

The facilitating effect of rapid alternating contraction of antagonistic muscle groups against maximal resistance can be applied in a number of specific techniques:

(a) *Rhythmic Stabilization.*[6-7-9] — This is a technique of rapid alteration of isometric contraction of antagonists against maximal resistance. The patient attempts to hold a rigid position of a joint and the therapist alternates maximal resistance in one plane in an attempt to move the joint. As an example: the patient holds the wrist rigid in the neutral position and the therapist rhythmically applies resistance alternately to the radial extensor, then the ulnar flexor, then radial extensor, etc. After the patient alternates isometric contraction of the antagonist muscles, the power of contraction of the muscles increases, following which maximal isotonic contraction of the agonist is performed repeatedly against resistance. Rhythmic stabilization is carried out in mass movement patterns and summated with other facilitation techniques for greater response.

Rhythmic stabilization is effective as a facilitation technique in patients with lower motor neuron lesions, lesions of the corticospinal tracts and basal ganglia. On the other hand, patients with cerebellar involvement fail to show facilitation from this technique and even fail to perform rhythmic stabilization successfully.[6-7-9]

(b) *Isometric Reversal of Antagonists.*[7] — In this method, alternating active motion of the antagonists is carried out against maximal resistance. This procedure can be performed using the entire range of joint motion or using a part of the range. This technique is applicable in all types of paralysis.

(c) *Isotonic Reversal of Antagonists with Isometric Contraction.* — In this facilitation method, the patient performs isotonic contraction of the antagonist through the range, then isometric contraction of the antagonist in the shortened range, followed immediately by active motion of the agonist through the range succeeded by holding with the agonist. The procedure is carried out against maximal resistance and usually repeated alternation of antagonistic muscle contractions is performed.

(d) *Quick Reversal of Antagonists.*[* 6-7] — In this technique of facilitation of voluntary motion, active motion of the antagonist is carried out through the range rather slowly against maximal resistance, then suddenly the motion is reversed and the agonist is contracted and assisted as rapidly as possible to the shortened position, immediately following which there is an isometric contraction of the agonist against maximal resistance.

One of the fundamental principles of functioning of the reflex centers in

* This technique was first suggested by one of our therapists, Miss Luba Brisker.

the spinal cord is successive induction.[3] If the flexion reflex is carried out in a spinal animal, immediately afterward the excitability of the antagonist response, the extension reflex in that limb, is considerably increased. In other words, the previous activity in the antagonist centers is followed immediately by a period of facilitation of the agonist pattern. The principle of successive induction is also applicable to voluntary motion.

While the response to weak cortical stimulation is contraction of the agonist with inhibition of the antagonist muscle group (reciprocal innervation), co-contraction results from increased intensity of cortical stimulation as well as from strong proprioceptive facilitation of a weak cortical stimulus.[19] In co-contraction, both antagonists contract simultaneously with stronger contraction of the agonist group. In therapeutic exercise with maximal facilitation of the motor response, co-contraction would occur and with this background of simultaneous excitation in both antagonists, alternation of antagonists should increase facilitation. When the agonist is resisted, the antagonist would be in a state of partial contraction and heightened excitability. When the resistance is reversed and suddenly applied to the antagonist, a stronger proprioceptive stimulus would be induced because the antagonist muscle is already partially contracted rather than flaccid. Furthermore, the facilitation of the antagonist is favored by the previous excitation of this muscle in co-contraction. This facilitation should build up higher with each reversal of the antagonists, for a time. Such a progressive increase in facilitation with repeated reversal of antagonists does in fact occur.[6-7-9] In addition, in isotonic reversal of antagonists carried through the range of motion, not only would the proprioceptive stimulation from resistance be greater, but the muscle would also be on maximal stretch at the moment of reversal of the antagonists.

Summary

1. For greatest effect in restoring power in paralyzed muscles, the goal should be maximal activation of the motor units of the affected muscles with each effort. A maximal voluntary muscular contraction is dependent on the highest possible level of excitation at synapses on the anterior horn cells, and can only be achieved through strong facilitation and summation of excitation in the central motor mechanisms.

2. From clinical experience and physiologic investigations on patients, we have applied a number of practical facilitation techniques which are valuable in the treatment of paralysis. These include:

(a) Resistance.
(b) Stretch.
(c) Mass movement patterns.
(d) Reflexes.
(e) Reversal of antagonists.

These techniques are combined for summation of facilitation. This new treatment program routinely applies mass movement patterns against resistance, and the old procedure of treatment of isolated muscles or isolated motions has largely been discarded. The usual routine of progressing gradually from passive motion, through assistive motion and free motion to resistance has also been eliminated.

3. A careful analysis of the physiologic mechanisms of these therapeutic facilitation techniques indicates that these methods have a sound fundamental basis. The recent experiments of Gellhorn on the influence of proprioception

on the functioning of the motor cortex and the older work of Sherrington, throw considerable light on these facilitation mechanisms. Gellhorn has clearly demonstrated the same facilitation effects from application of resistance, stretch and mass movement patterns on the response to electrical stimulation of the motor cortex in the monkey as we have found in voluntary motion in patients. Gellhorn's experimental evidence that a mass movement pattern results from threshold electrical stimulation of an individual focus of the motor cortex in the monkey illustrates the fundamental nature of these patterns. Sherrington demonstrated that deafferentation renders a limb entirely and permanently incapable of voluntary motion, even though the response to electrical stimulation of the motor cortex is unimpaired.

The underlying physiologic mechanism of resistance, stretch and mass movement patterns is essentially proprioceptive. Postural and righting reflexes and related facilitation techniques are also proprioceptive in nature. The facilitating effect of reversal of antagonists is due to successive induction, proprioceptive stimulation, and co-contraction.

These powerful proprioceptive facilitation mechanisms have been harnessed for the more effective treatment of paralysis.

Discussion

Dr. Harriet Gillette (Atlanta, Ga.): A significant contribution to the armamentarium of physical therapy procedures has been made by Dr. Kabat. The concept of patterns of movement as opposed to isolated contractions is being considered more now than ever before, and is supported by increasing knowledge of cortical and subcortical mechanisms.

The term "paralysis" is a broad one, which includes clinical pictures of abnormal muscle movement brought about by destruction of any one of several different nervous mechanisms. Pyramidal tract lesions differ from extrapyramidal both to the eye and electromyographically. Spinal cord lesions may destroy anterior horn cells, as well as central facilitory or inhibitory centers. The effector organ, the muscle, knows only contraction; but this function is governed by a multitude of controls.

Patients vary widely in age, temperament, mentality, general health and stamina; and each requires an individualized treatment program, taking into account all the factors which go to make up a whole person.

A consideration of body mechanics, with prevention or correction of deformity and with even distribution of muscle strength throughout trunk and extremities, is of utmost importance in poliomyelitis; and it can be best achieved through isolated muscle reeducation. Power is not always the desired end result; on occasion it may be desirable to sacrifice power for ease and grace of motion. Passive and active assistive motion still are indispensable adjuncts in the treatment of many forms of disability.

The techniques of central facilitation as outlined by Dr. Kabat are successful and useful ones. I personally have experienced gratifying results with the use of some of them. However, I am constantly reminded that the art of medicine lies in a knowledge of the application and the judicious use of its many tools.

THE SO-CALLED BICIPITAL SYNDROME OF THE SHOULDER *

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The purpose of this paper is to call attention to a clinical entity, bicipital tendinitis, bicipital tenosynovitis, or bicipital syndrome of the shoulder joint, with which my observations lead me to believe the members of the Medical Profession in general are unfamiliar, but which constitutes a major factor in the production of an ailment with which all of us are only too familiar, that of the painful, stiff shoulder. A substantial part of the practice of most orthopedic surgeons is made up of the care and treatment of this condition. It is undoubtedly the most common ailment of the shoulder and is of great importance not only because of its frequency of occurrence but also because of the prolonged disability it generally entails. Although in relatively recent years much enlightening information on this subject has been provided by various workers, we have not yet arrived at a complete understanding of the etiology and pathogenesis of this symptom complex.

In speaking of the painful, stiff, or "frozen" shoulder, reference is made to that clinical syndrome of pain of varying intensity occurring in the shoulder with or without antecedent trauma, associated with limitation of motion of varying degrees, but characteristically progressing to almost complete restriction, the so-called frozen shoulder. It is infrequently seen in individuals under 40 years of age, and its course is characteristically exceedingly protracted, extending over periods of months to years, and generally terminating in spontaneous recovery. It should be pointed out that, contrary to the general conception, all cases do not eventuate in complete spontaneous cures in four months to three years. There are many who never spontaneously regain normal function.

Until Duplay[1] in 1896 presented his belief that the extra-articular tissues of the scapulo-humeral joint as distinct from the intra-articular structures, were the primary source of pain and limitation of motion, this condition was considered as arthritis of the shoulder joint. Duplay's description corresponds to what we now think of as "frozen shoulder." He regarded the subacromial bursa as a separate joint, and assigned inflammation of this bursa as the cause of the condition, designating it "scaplo-humeral periarthritis."

About the time of the appearance of Duplay's paper, x-ray came into use, and then for the first time calcific deposits were observed in the periarticular tissues of the shoulder joint. Painter[2] in 1907 and Baer[3] in the same year published the first papers in this country on the subject. They believed that these deposits might be the cause of pain and restricted motion in the shoulder and recommended their surgical removal as the indicated treatment. But, since these deposits were observed in shoulders without pain, as well as in those with pain, the general term periarthritis continued to apply to the painful, stiff shoulder, with or without calcium deposits. Though King and Holmes[4] in 1927 urged that interpretation of the symptoms be based on the

* Read at the Twenty-ninth Annual Session of the American Congress of Physical Medicine, Denver, Colorado, September 7, 1951.

1. Duplay, S.: De la Periarthrite Scapulo-humérale, Rev. prat. d. trav. de méd. 53:226, 1896; Rev. prat. on Scapulo-Humeral Periarthritis (Paris Clinical Lectures), Med. Press 69:571, 1900.
2. Painter, C. F.: Subdeltoid Bursitis, Boston M. & S. J. 156:345, 1907.
3. Baer, W. S.: Operative Treatment of Subdeltoid Bursitis, Bull. Johns Hopkins Hosp. 18:282, 1907.
4. King, J. M., Jr., and Holmes, G. W.: Diagnosis and Treatment of 450 Painful Shoulders, J. A. M. A. 89:1956, 1927.

pathologic process, Mumford and Martin[5] in 1931 and Dickson and Crosby[6] as late as 1932, expressed the view that there was no clinical difference between the painful stiff shoulders with calcium deposits and those without.

It was at this period that Doctor E. A. Codman's[7] exhaustive book on the shoulder appeared. This work provided abundant information relative to the pathogenesis of the painful stiff shoulder. It served to separate from the general group of cases of pain and limited motion of the shoulder, designated "periarthritis," three distinct clinical entities: calcareous tendinitis, rupture of the supraspinatus tendon, and the frozen shoulder. While the etiology and pathology of the former two, calcareous tendinitis and rupture of the supraspinatus tendon, were presented with such clarity and comprehensiveness that little has been added since, the "frozen shoulder" presented an unsolved problem to him. He expressed himself as of the opinion that the biceps tendon and its sheath had little to do with the production of pain and restricted motion.

It has, however, become increasingly apparent that this structure, the biceps tendon, is of considerable importance in this clinical syndrome, and it is now being assigned a major role. During the second decade of this century, A. W. Meyers[8] in a series of papers presented a wealth of information relative to various changes in the biceps tendon, its sulcus and related soft tissue structures. His investigations involved the dissection of approximately 2,000 shoulder joints and yielded convincing evidence that the intertubercular sulcus, the biceps tendon and associated structures must play an important role in the production of the painful shoulder with restricted motion. He observed evidence of degenerative and attritional changes as manifested by fraying, thinning and irregular splitting of the biceps tendon. In a number of shoulders he found complete absence of the intra-articular portion of the tendon and further that the extra-articular tendon had securely attached itself in the region of the sulcus and the lessor tuberosity. In several specimens he found dislocation of the tendon from its sulcus.

Up to this time, these findings apparently had no clinical counterpart. Dr. Meyers stated, "Such cases apparently do not appear in clinics and dispensaries, for pathologists and orthopedic surgeons seem to be unfamiliar with them." In 1934, Codman[7] wrote in reference to the production of shoulder symptoms, "Personally, I believe that the sheath of the biceps tendon is less apt to be involved than are the other structures. I have never proved its involvement in a single case." Shortly before this, however (1926), Gilcreest,[9] in discussing rupture of the tendon of the long head of the biceps based on clinical analysis of 100 cases, suggested implication of the biceps tendon in the painful shoulder. He considered "acute" and "latent" ruptures and felt that the latter were overlooked and diagnosed as arthritis or bursitis.

It was not, however, until about 18 years ago that the bicipital syndrome, or bicipital tendinitis was enunciated as a clear-cut and separate clinical syndrome. The enlightening and original work of Pasteur[10] served to provide the clinical counterpart to the exhaustive anatomic investigations and ob-

5. Mumford, E. B., and Martin, F. J.: Calcified Deposits in Subdeltoid Bursitis, J. A. M. A. **97**:690, 1931.
6. Dickson, J. A., and Crosby, E. H.: Periarthritis of the Shoulder: Analysis of Two Hundred Cases, J. A. M. A. **99**:2252, 1932.
7. Codman, E. A.: The Shoulder. The Author, 1932.
8. Meyers, A. W.: (a) Unrecognized Occupational Destruction of the Tendon of the Long Head of the Biceps Brachii, Arch. Surg. **2**:130, 1921; (b) Spontaneous Dislocation of the Long Head of the Biceps Brachii, ibid. **13**:109; (c) Spontaneous Dislocation and Destruction of the Tendon of the Long Head of Biceps Brachii, ibid. **17**:493, 1928.
9. Gilcreest, E. L.: (a) Subcutaneous Rupture of the Long Head of Biceps Flexor Cubiti, S. Clin. North America **6**:547, 1926; (b) Dislocation and Elongation of Long Head of Biceps Brachii, Ann. Surg. **104**:118, 1936.
10. Pasteur, F.: La teno-bursite beicipitale, J. de radiol. et d'électrol. **16**:419, 1932.

servations of Dr. Meyers, made in the dissection room. He used the term "teno-bursite bicipitale" in referring to this syndrome and suggested that tenosynovitis of the long head of the biceps was the esesntial pathologic factor underlying the painful, stiff shoulder, and he definitely related it to the "frozen shoulder." Shortly after the appearance of Pasteur's work Shrager's[11] excellent paper appeared, supporting and amplifying Pasteur's observations. He clearly presented and established, perhaps for the first time in American literature, tendinitis of the long head of the biceps as a clinical entity.

Having finally established the bicipital syndrome as a definite clinical entity, what is the present status of our knowledge concerning this symptom complex? Have we arrived at a complete understanding of the etiology and pathogenesis of this ailment? Has its relationship to the painful, stiff and "frozen shoulder" been clearly and definitely established? It is my belief that several workers interested in this problem in recent years have gone far to provide us with an affirmative answer to these queries.

Lippmann[12] explored 32 shoulder joints involved in the so-called periarthritis or pain and restricted motion, and found tenosynovitis of the long head of the biceps to be present in all. In only one instance was rupture of the musculo-tendinous cuff observed and in two cases adhesions in the subacromial bursa were noted. He considered that interpretation of his findings left only two alternatives, either involvement of the tendon of the long head of the biceps is incidental to a pathologic process or the changes in this structure represent a "basic element of the disease." The former he rejects as untenable and accepts the alternative, "that tenosynovitis of the long biceps tendon constitutes the underlying pathologic basis of at least most cases of so-called periarthritis," and he recommends that the term bicipital tenosynovitis be employed rather than periarthritis.

Lippmann is of the opinion that his operative findings suggest an explanation of the sequence of events incident to the development of the symptom complex of the typical painful, stiff shoulder and of its eventual spontaneous recovery. He maintains that when the clinical symptoms are correlated with the pathologic findings at operation, it is apparent that the early pain and associated restricted motion are incident to the active inflammatory involvement of the biceps tendon mechanism. As the process subsides and the biceps tendon becomes firmly anchored in the intertubercular groove by dense adhesions, pain vanishes and motion gradually returns. The author suggests an explanation of the exact manner in which bicipital tenosynovitis of the long biceps tendon produces the so-called frozen shoulder. He points out that inflammatory process involves the biceps tendon both in its intra-articular and extra-articular portions; that dense adhesions are formed, which bind the tendon not only to the bicipital sulcus outside of the joint, but to the capsule above the tendon and to the articular surface of the head of the humerus below the tendon, within the joint. Adhesive subacromial bursitis, contractures incident to prolonged immobilization, and mechanical block resulting from intra-articular infolding of the biceps tendon, he dismisses as untenable and not in accord with his observations at operation.

Hitchcock and Bechtol[13] likewise feel that lesions of the tendon of the long head of the biceps are among the most frequent causes of pain and restricted motion of the shoulder joint. Twenty-six cases of the clinical syndrome of bicipital tenosynovitis, that is, pain and restricted motion in the

11. Schrager, V. L.: Tenosynovitis of the Long Head of the Biceps Humeri, Surg. Gyn. & Obst. 66:785, 1938.
12. Lippmann, R. K.: Frozen Shoulder; Periarthritis; Bicipital Tenosynovitis, Arch. Surg. 47:283, 1943. N. Y. State J. of Med. 44:2235, 1944.
13. Hitchcock, H. H., and Bechtol, C. O.: Painful Shoulder, J. Bone and Joint Surg. 30-A:263, 1948.

shoulder, tenderness localized to the bicipital sulcus, and pain caused by digitally displacing the biceps from side to side, they submitted to surgery. All cases revealed pathologic involvement of the biceps tendon-tendon-sheath structures. Excision of the intracapsular portion of the tendon and fixation of the extracapsular portion in the bicipital sulcus yielded most satisfactory results in every case. The authors maintain that the frequency of involvement of the biceps tendon and the pathologic changes observed involving this structure, result from predisposing factors in combination with phylogenetic and functional influences. Of major importance as predetermining factors they consider the so-called supra-tubercular ridge, first mentioned by Meyers,[8] 1928, and an abnormally shallow intertubercular sulcus. From the phylogenetic point of view they have found that in respect to the conformation of the bicipital groove man is unique among the primates. They observed in a study of shoulder specimens of the gorilla (22), chimpanzee (38), gibbon (28), and orangutan (18), that the angle of the medial wall was identical in all. Review of 100 human humeri revealed, on the other hand, marked variations in the depth of the groove, as expressed by the angle of the medial wall. The supra-tubercular ridge, which is in reality a continuation onto the head of the humerus of the medial wall of the bicipital sulcus, they found to be present as a complete structure in 8 per cent of the specimens and as a partial ridge in 59 per cent. They feel that the presence of a small spur off the tip of the lesser tuberosity in 45 per cent of the humeri with a supra-tubercular ridge, and in only 3 per cent of those without such a ridge indicates previous inflammatory activity as the result of abnormal pressure against the fibrous roof of the biceps tendon.

The James Edwards Professor of Orthopedic Surgery at the Jefferson Medical College, Doctor A. F. DePalma,[14] has written a large volume on the shoulder which was recently (1950) published. It is fundamentally sound and constitutes by far the most comprehensive work on the shoulder yet to appear. It is unique in that the author presents observations based on a combination of a very large clinical experience and a most extensive anatomic and pathologic investigation. He has gone further, however, and by inquiry and examination painstakingly gathered clinical information with reference to the shoulder on a large number of patients hospitalized for various ailments. Upon the death of many of these patients he was later able to study their shoulder joints at the autopsy tables. The section dealing with the paintul, stiff shoulder comprehends the largest number of cases so far recorded. It is based on the clinical investigation of 83 cases, 56 of which he operated on. He has attempted to correlate these operative findings with those observed in his extensive investigation of degenerative lesions of the shoulder, embracing a study of 452 shoulder joints. Three hundred and eight of them were cadaver specimens. He explored at autopsy 144 shoulders, a history and examination of the shoulder having been obtained prior to death on all of this group. Only those shoulders were studied at autopsy which previous clinical inquiry and examination indicated were free of pathologic involvement. As a result of these extensive investigations and his findings at surgery; viz., that all 56 shoulders on which he operated revealed varying degrees of involvement of the tendon-tendon-sheath gliding mechanism of the long head of the biceps, he concludes that bicipital tenosynovitis is the most common cause of the so-called "frozen shoulder."

The author explains the characteristic restricted motion of this group of cases on the basis of voluntary immobilization incident to the painful motion

14. DePalma, A. F.: Surgery of the Shoulder, J. B. Lippincott Co., Philadelphia, 1950.

resulting from bicipital tenosynovitis in shoulder joints already exhibiting "profound degenerative alterations in the synovialis, the musculo-tendinous cuff and biceps tendon." This he holds to be the reason that frozen shoulder rarely occurs in individuals under 40 years of age. He points out that bicipital tenosynovitis, playing as it does a major role in the symptomatology and course of the painful stiff shoulder, is the "prime causative factor responsible for pain both in the early and late phases of the disease." This he concludes on the basis of the clinical findings of pain and tenderness over the bicipital groove and the biceps tendon and the "dramatic and instantaneous relief of pain" in this series of cases after the removal of the intracapsular portion of the degenerated and adherent tendon and the relocation and fixation of the extracapsular portion.*

Summary and Conclusion

Periarthritis, or the painful stiff shoulder, is a very disabling ailment which is characteristically of prolonged duration, six months to three or four years. An attempt has been made to indicate the fact that pathologic changes in the biceps tendon probably play a major role in the production of this symptom complex.

Discussion

Dr. John H. Kuitert (Wash., D. C.): Dr. Newman is to be complimented on so ably and clearly accomplishing the stated purpose of his paper, which is to reemphasize the bicipital syndrome as a clinical problem. He has carefully traced the historical events in the development of this concept and as a result of his own observations he assigns a major role to the biceps mechanism in the production of the clinical "frozen" shoulder.

Cinematography has shown that some of our previous concepts concerning relative motions of the shoulder joint proper should be revised. It now appears that the first 90 degrees of flexion and abduction occurs in the shoulder joint proper, after which elevation is carried out by rotation of the scapula on the chest wall in which movements of the sterno-clavicular and acromio-clavicular joints take part. Complete elevation in abduction is associated with external and/or internal rotation of the humeral head to avoid impingement of the head on the acromial process. Thus, if rotation is limited by adhesions, glenohumeral range may be restricted.

Lippmann has pointed out:

> "(1) No motion of the biceps tendon in its groove can be produced by contraction of the biceps if the shoulder is held immobile.
> (2) Any motion of the shoulder joint entails motion of the bicep tendon in its grooves."

Clinical lesions of the biceps tendon may have been overshadowed by the writings of Codman, who focussed attention on the supraspinatus tendon; Dr. Newman's observations are in agreement with Moseley who has said "when the bicipital syndrome is correctly diagnosed it will be found equal in importance and numbers to the lesions of the rotator cuff in causing shoulder pain."

The term "frozen shoulder" is common but somewhat unsatisfactory and perhaps should be reserved for the clinico-pathological syndrome in which little to no active or passive motion is possible in the shoulder joint without actual intraarticular ankylosis being present. Used in this sense it is difficult to limit the cause of the condition to bicipital tendinitis alone.

Dr. Martin in his essay on fibrositis pointed up a gradually painful, slowly stiffening shoulder which he has treated as an inflammatory condition.

Exercise and unusual use of the biceps and its tendon has produced no shoulder disease in thirty below-elbow amputees subjected to biceps kineplasty for energizing a prosthetic device, at Walter Reed Army Hospital during the calender year 1950. Hansson has pointed out that "frozen shoulder" as just defined, frequently accompanies any painful condition of the upper limb; he stresses the need for reeducation in the use of the intrinsic shoulder muscles in this group of patients. It should be pointed out that the shoulder joint presents a relatively short lever arm energized by powerful, thick muscles which are prone to marked spasm and rapid atrophy. I have been impressed with the need for active relaxation of the shoulder girdle in these patients as suggested by Seidelin.

I certainly agree with Dr. Newman that the "frozen shoulder" is a rather common cause for severe disability and that its treatment is difficult. His operative results speak for themselves, although the number

* A presentation of illustrative cases surgically explored and of pertinent dissections of fresh autopsy material was given. This was very largely dependent upon projection of color lantern slides. Since black and white prints of color slides lose so much in the process of reproduction as to make them almost meaningless on the published page, it was thought wise to dispense with the publication of this part of the presentation.

of reported cases is small and the follow-up on them is rather short. I should like to ask Dr. Newman how he selects the patient whose pathology is definite and what are his criteria for diagnosis of the surgical bicipital syndrome; what are the effects of procaine needling and has manipulation under anesthesia any place in the management of the condition. I again wish to compliment Dr. Newman on the clarity of his presentation and appreciate the opportunity to discuss his observations and results.

THERAPEUTIC TEACHING *

Group Work in Physical Therapy

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and

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Rehabilitation, especially of the severely and chronically disabled has increased the patient load of most physical therapy programs during the past decade. Almost every month a new group, previously neglected or considered hopeless, is added to the ever increasing load requiring physical rehabilitation. Since the number of qualified physical therapists has not and cannot increase as rapidly as this patient load, it became obvious to many of us in the field that with our present methods of therapy, the saturation point would soon be reached. And indeed it has been reached in many good physical therapy programs throughout the country.

Too frequently good programs have been reduced to mediocrity because, for one reason or another, too large a case load had to be accepted. This has often resulted in disappointing results both from the viewpoint of the patient as well as from that of the medical unit.

In an effort to alleviate this present crisis, a number of institutions have utilized group work instead of individual treatment in certain phases of physical rehabilitation. At the New York State Rehabilitation Hospital, West Haverstraw, New York, the Physical Rehabilitation Section has attempted to do this by the organization of previously known techniques of group therapy into a single, effective working tool. We have designated this form of methodology for groups as "therapeutic teaching."

Therapeutic teaching may be defined as that form of physical therapy administered within a group situation in conformance with accepted pedagogical principles and fundamental concepts of rehabilitation. The lack of detailed instructional material set forth in logical, coherent sequence, has probably been the main factor in the retardation of the use of this method. One of the purposes of this paper is to furnish such detailed instructions. A second aim of this paper is to stress again the thought that the physical therapist must also be a teacher — especially in physical rehabilitation procedures. Guthrie-Smith[1] expresses the opinion that the physical therapist must ap-

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1. Guthrie-Smith, Olive F.: Rehabilitation, Re-education, Remedial Exercises, The Williams & Wilkins Co., Baltimore, Maryland, 1943.

proach the patient as a teacher rather than as one who merely carries out a prescribed order of treatment. More colloquially, the successful therapist-teacher "works *with* the patient, not *on* him."

Controversy exists today concerning the problem of how the severely disabled individual may be best aided in achieving total independence in the functional physical activities required in daily living. The focus of attention in physical therapy has been centered on programs of individual therapy. We feel that this concept of individuality can still be maintained in properly organized programs of therapeutic teaching by emphasizing individual attention and instruction within any given group. We do not take issue with the fact that the best approach to therapy is on the individual basis. It is only when administrators are confronted with personnel shortages and excessive patient complements that group procedures are recommended.

Preparing and carrying out a therapeutic teaching program on a rational basis rather than chance, requires a plan for presenting an organized and progressively arranged body of functional exercises and activities. It should include a large range program or *rehabilitation syllabus*, and a daily program or *treatment plan*. The rehabilitation syllabus has as its purpose the assurance of a well-balanced physical rehabilitation plan in which consideration must be given to available facilities and equipment, staff personnel, time available for rehabilitation activities, and progressively increasing ability groups. The daily treatment plan, on the other hand, represents the therapist's own work sheet of therapeutic teaching procedure to be used, consistent with the needs of the individual patients in the group, at each level of progression from day to day.

Rehabilitation Syllabus

The rehabilitation syllabus offered in this paper (Tables 1, 2, 3, 4, 5, 6) represent the physical experiences the severely disabled will encounter in daily living. Its scope of planned experiences ranges from mat exercises to ambulation and functional retraining with wheelchair, braces, and crutches. The syllabus defines the various therapeutic groups, setting forth where one level ends and the next begins, which in actual administration must permit wide latitudes of overlap. Although in print, these groups would appear to be quite fixed and rigid, they merely represent flexible working guides in the preparation and administration of a daily treatment plan. The functional activities suggested in the syllabus are based on the "104 Daily Activity Test" listed by Deaver and Brown,[2] and may be modified or varied to meet the particular group situation with which therapists may deal.

This presentation is concerned only with the rationale of therapeutic teaching, and its program of various progressions to full physical rehabilitation. No reference is made to the physiologic aspects of the various exercises and activities used, the indications for their use, or even the results that may be attained. No attempt is made to describe or analyze the exercises or activities, or to justify the order of activities in the sequence of progression. The units of the syllabus of rehabilitation herewith presented (Tables 1, 2, 3, 4, 5, 6) were developed to meet the needs of the New York State Rehabilitation Hospital and is considered flexible enough to be offered as a basis or guide in building up a therapeutic teaching program to be adapted by others to their own situations.

2. Deaver, George D., and Brown, Mary Eleanor: The Physical Demands of Daily Life, published by the Institute for the Crippled and Disabled, New York.

TABLE 1. — *Mat Class. Aim: To Correlate and to Contribute, Through the Administration of Exercise Therapy, to the Development of the Individual in Attaining the Basic Strength, Flexibility, Coordination and Balance Necessary for Effective Mastery in Rehabilitation Fundamentals.*

Unit I. — Therapeutic Exercises.	Unit II. — Functional Exercises.[c]
Content.	Content.
Element A. General Exercises.[a]	Element A. Lead-Up Functional Exercises.[d]
1. Active Exercises. a. Flexibility Exercises (e. g., active stretching exercises, etc.). b. Strength and Endurance Exercises (e. g., movements related to big muscle activity, light dumbbell exercises, medicine ball activities, etc.). c. Coordination Exercises (e. g., elementary neuromuscular movements, etc.). d. Balance Exercises.	1. Lead-Up Functional Exercises Without Apparatus. 2. Lead-Up Functional Exercises with Apparatus. (e. g., sawed-off crutch exercises, bench exercises, etc.).
Element B. Specific Exercises.[b]	Element B. Functional Activities.[e]
1. Specific Balance Exercises. a. Sitting Balance Exercises (e. g., use of small graded boxes for push-ups, dips, etc.). b. Kneeling Balance Exercises (e. g., use of graded benches for kneeling drills, etc.). 2. Sawed-Off Crutch Activities. a. Sitting Crutch Activities. b. Kneeling Crutch Activities. 1. Preliminaries of Learning to Break a Fall and How to Discard Crutches. 3. Standard Crutch Exercises. a. Crutch Drills. 1. Preliminary Crutch Training Performed in the Supine Position Using the Wall as a "Floor-Base."	1. Moving 20 Feet on Floor in Other Than Erect Position. 2. Ascending and Descending Stairs Without Crutches and Braces. 3. To Floor from Wheelchair and Return.

a. Through a prescribed program of kinesiologically sound exercises favorable to the best principles involving therapeutic exercises, the purpose of prescribed general exercises is to improve muscle tone, increase respiratory and vascular efficiency, and stimulate general metabolism.

b. Prescribed specific exercises assume a rightful role of importance in rounding out the "conditioning" of the patient, which is predicated upon the development and amelioration of specific neuro-muscular and muscular-skeletal dysfunctions or weaknesses not reached through prescribed general exercises.

c. The use of prescribed functional exercises in the mat class is for the purpose of developing facility and independence in certain daily activities which are considered a problem for the patient commensurate with his existing level of recovery or retraining. Functional exercises are of two types, lead-up functional exercises and functional activities.

d. Lead-up functional exercises are those isolated fundamental movements of a particular daily activity which, if properly used, will lead to increased ability to perform the whole activity.[3]

e. Functional activities are herein regarded as those selected essential activities for daily living commensurate with the patient's contemporary abilities which, more than likely, he will have to master for independent living.

3. Hoberman, Morton; Cicenia, Erbert F.; Dervitz, Hyman L., and Sampson, Oscar C.: The Use of Lead-up Functional Exercises, The Physical Therapy Review 31:321 (Aug.)1951.

Treatment Plan

The daily treatment plan is a combination of activities, selected from the syllabus of rehabilitation, in accordance with patients' present needs, interests, and abilities. The activities comprise a single treatment period with a proportionate amount of time allotted to each activity. The daily treatment plan is prepared in writing by the therapist for each group and should be subject to approval by the supervisor. In planning a daily program the therapist should select activities from the various elements of the units, so as to give a well-balanced development. The importance of writing out programs in advance cannot be overemphasized. The specimen plan which follows (Table 1[1], p. 544) merely suggests a method which may be used.

TABLE 2. — *Wheelchair Class Aim: To Make the Individual as Independent as Possible in Certain Selected Essential Wheelchair Activities.*

Unit I. — Activities Without Braces.	Unit II. — Activities with Braces.
Content.	Content.
Element A. Wheelchair Management.	Element A. Daily Activities with Wheelchair.
1. Controlling Footrests.	1. Moving from Bed to Wheelchair and Return.
2. Controlling the Wheelchair.	2. Moving from Chair to Wheelchair and Return.
a. Propelling (e. g., over doorsills, carpets and rugs, up and down ramps, etc.).	3. Moving from Wheelchair to Toilet and Return.
b. Turning.	4. Moving from Wheelchair to Car and Return.
c. Opening and Closing Doors from Wheelchair.	
Element B. Daily Activities with Wheelchair.	
1. Moving from Bed to Wheelchair and Return.	
2. Moving from Chair to Wheelchair and Return.	
3. Moving from Wheelchair to Toilet and Return.	
4. Moving from Wheelchair to Bathtub and Return.	
5. Moving from Wheelchair to Car and Return.	
a. Management of Wheelchair Into and Out of Car.	

TABLE 3. — *Parallel Bar Class. Aim: To Develop Levels of Proficiency Within the Individual in Pre-Ambulation and Pre-Crutch Fundamentals, and to Continue Specialized Work Emphasizing the Development of Those Elements (Strength, Balance, Coordination) Necessary for Such Activity.*

Unit I. — Therapeutic Exercises.	Unit II. — Functional Exercises.	Unit III. — Elementary Gait Patterns.	Unit IV. — Crutch Bar Drills.f.
Content.	Content.	Content.	Content.
Element A. Specific Exercises.	Element A. Balance Exercises.	Element A. Forward Gaits.	Element A. Balance Exercises.
1. Push-Ups.	1. Point of Balance (e. g., correct standing posture and stance).	1. Drag-to Gait.	1. Crutch Stance.
2. Hip Raising and Leg Swinging.	2. Body-Weight Shifting.	2. Swing-to Gait.	a. Point of Balance.
3. Special Resistive Exercises (e. g., for hypertrophy of the lower trapezius and latissimus dorsi. (4.)	Element B. Pre-Elevation Drills.	3. Swing-Thru Gait.	2. Balance Drills.
	1. Stair and Curbs (e. g., utilizing different sized benches or stools placed between the parallel bars).	4. Four-Point Gait.	3. Body-Weight Shifting.
		Element B. Backward Gaits.	4. Crutch Placement.
		1. Four-Point Gait.	
		2. Back "Jacks."	
		3. Swing-Thru Gait.	
		Element C. Sideward Gait.	
		1. Four-Point Side Step.	
		2. Two-Point Side Step.	

f. Preliminary crutch management elements are presented by use of wide parallel bars, permitting freedom of independent movement and at the same time affording the patient safety until he has the necessary confidence to progress to crutch management outside the bars.

4. Abramson, Arthur S.: Principles of Bracing in the Rehabilitation of the Paraplegic, Bull. Hosp. Joint Dis., Vol. X, No. 2, October, 1949.

TABLE 4. — *Crutch Management Class.*[g] *Aim: To Firmly Establish Gait Patterns Preparatory to the Teaching of the Beginnings of Endurance as Well as Stress the Mastery of Certain Daily Activities Consistent with This Stage of the Patient's Level of Retraining.*

Unit I. — Crutch Stances.	Unit II. — Gait Training.	Unit III. — Functional Training.
Content.	Content.	Content.
Element A. Establishing the Point of Balance. 1. Posture and Stance. Element B. Balance Activities. 1. Balance Drills. 2. Body-Weight Shifting. 3. Crutch Placement.	Element A. Forward Gaits. Element B. Backward Gaits. Element C. Sideward Gaits. Element D. Pivoting and Turning.	Element A. Daily Activities. 1. Sitting Down and Getting Up from Varied Sized Chairs. 2. To and from Bed with Crutches. 3. To and from Toilet with Crutches. 4. Getting Down and Up from Floor. a. With Help (e. g., assistance of second person, articles of furniture, wall, door, etc.). b. Without Help. 5. Elementary Falling Techniques.

g. In order to facilitate the patient's advancement to an ambulatory status, an intermediate level between parallel bars and complete ambulation has been established in the form of a prescribed crutch management class.

TABLE 5. — *Progressive Ambulation Class.*[h] *Aim: To Begin the Preliminaries of Endurance for Physical Activity by Gradually Developing the Patient's Ambulatory Endurance to Five Hundred Feet Within an Acceptable, Practical Length of Time Without Undue Fatigue, and to Teach Daily Activities Commensurate with This Level of Progression.*

Unit I. — Ambulation.	Unit II. — Functional Activities.
Content.	Content.
Element A. Elementary Endurance Activities. 1. Progressive Development of the Individual's Capacity to Ambulate Approximately 500 Feet in a Practical Length of Time Without Undue Fatigue.	Element A. Daily Activities. 1. Opening and Closing Doors. 2. Passing Through a Revolving Door. 3. Passing Through a Turnstile. 4. Ascending and Descending Ramps. 5. Ascending and Descending Stairs with Handrail. 6. Ascending and Descending Curbs. 7. Ascending and Descending Stairs. Without Handrail. Element B. Advanced Falling Techniques.

h. Until this point the program has been concentrating on the acquisition of the necessary strength, balance, coordination, and mastery of skills which facilitate the handling of the body efficiently. Progressive ambulation aims to utilize these learned skills in the development of endurance and tolerance for physical activity.

TABLE 6. —*Endurance Class.*[i] *Aim: To Develop the Maximum Ambulatory Endurance of Which the Individual Is Capable and to Improve Tolerance in Elevation and Traveling Activities with a View Toward the Complete Severance of the Individual From Dependence Upon a Wheelchair in Accordance with the Limits Imposed by the Disability.*[j]

Unit I. — Ambulatory Activities.	Unit II. — Elevation Activities.	Unit III. — Traveling Activities.	Unit IV. — Endurance Activities.
Content.	Content.	Content.	Content.
Element A. Locomotion Progressions.	Element A. Climbing Progressions.	Element A. Traveling Progressions.	Element A. Total Endurance.
1. Ambulate to and from Rehabilitation Clinic and the Ward.	1. Ascending and Descending Flights of Stairs.	1. Crossing Street with Traffic Light.	1. Carry on a Program of Normal Activities Without a Wheelchair for Progressive Periods of Time (e. g., two hours, four hours, six hours, eight hours, until bedtime, etc.).
2. Ambulate About the Various Corridors of the Hospital.	2. Ascending and Descending Bus Steps.	2. Sitting Down and Getting Up from Theatre Seats, Restaurant Booth, Bar Stool, Etc.	2. Obstacle Course of Functional Activities. (Determined by the individual needs, interests, and abilities of the members of the group.)
3. Ambulate ¼ of a Mile.	3. Ascending and Descending Train Steps.	3. Picking Up and Carrying Objects.	
4. Ambulate ½ of a Mile.		Element B. Automobile Activities.	
5. Ambulate One Mile.		1. Moving to and from Automobile with Braces and Crutches.	
		Element C. Travel Test.	
		1. Travel Test Activities.[k] (Determined by the individual post-hospitalization needs of the members of the group.)	

i. The concern at this level, is not solely with the elements of distance and speed (e. g., ambulate specified distances in a reasonable time), as is the goal of the prescribed progressive ambulation class, but also with the element of capacity (e. g., carrying on a program of normal activities without the use of a wheelchair for two hours, four hours, etc.) depending upon the patient's needs and abilities.

j. When the patient is ready for the endurance level, he should have more or less reached a plateau in the process of retraining the physical residuals of the disability. In other words, at the endurance level, the patient has developed the strength and acquired fundamental techniques commensurate with the extent of involvement, but now requires practical application of such power and knowledge to specific conditions. Here, attempts are made to progressively do without the wheelchair for increasing periods of time. Instead of climbing a few practice stairs, the patient works to develop the endurance needed to climb *flights* of stairs and experiments with a myriad of types of steps, stairs, and staircases. The patient's home and vocational situation is reviewed, and special endurance, elevation, and travel experiences are set up to simulate the contemplated post-hospital needs of the individual and/or the group.

k. Travel Test: As a climax to the functional retraining program, patients (when indicated by the physician concerned) are taken into "town" and given the opportunity to find out for themselves just what they can and cannot do in practical everyday situations away from the protective and secure hospital environment. With a therapist acting as a guide, the travel test, except for minor variations according to specific individual needs, consists of the following itinerary: Hospital to train depot via hospital station wagon . . . purchase train ticket and board train to the next station . . . bus or taxi to the center of town . . . shopping tour offering a variety of "true-to-life" experiences to be performed as independently as possible . . . return to hospital via public vehicles of transportation.

Classification of Patients

For practical administrative purposes, when a patient is admitted to the Physical Rehabilitation Section, the physician in charge places the patient in one of the five rehabilitation categories based on test results (e. g., muscle test, daily activity test). These are (1) *ambulatory patients* (A) — patients who are or have the potential for complete ambulation and independence with or without braces and crutches, (2) *wheelchair patients* (W) — patients who must, or eventually will spend all their time in a wheelchair, but are capable of performing most or all the essential activities of daily living independently, (3) *predominantly ambulatory* (PA) — patients who are able or will be able to independently

TABLE 1.[1] — *Daily Treatment Plan.*

Date: 7/11/51. Time: 3:00-3:45 P. M. Therapist: Marino.
Activity: Crutch Management Class.

PATIENTS.	REHABILITATION CATEGORY.
Howell, B.	P. A.
Brown, R.	P. A.
Draznk, A.	P. W.
Lugar, T.	A.
Frey, F.	P. A. (New Patient).

A. WARM UP AND PREPARATORY MOVEMENTS — 5 Minutes.
H. B. D. and L. — General Balance Drills and Crutch Placement Activities.
Frey — Indoctrination, Teach Crutch Balance Stance.

B. REVIEW — 15 Minutes.
H. B. D. and L. — Review Turning and Pivoting Movements. Teach Four Point Gait Fundamentals Forward and Backward; Check Lugar on Gait Patterns.

C. NEW MATERIAL — 20 Minutes.
All Patients — Explain and Demonstrate Fundamentals of Sitting Activities. Have All Patients Except Frey, Perform Activity Under Supervision.
Frey — Teach Crutch Balance Drills.

D. PRACTICE — 5 Minutes.
Howell and Brown — New Material.
Draznk — Pivoting and Turning. Also New Material.
Lugar — Four Point Gait, Increased Cadence.
Frey — Balance, Stance, and Drills.

perform a majority of ambulatory or functional activities with or without braces and crutches, but for whom it is acceptable and practical under certain circumstances to use a wheelchair, (4) *predominantly wheelchair* (PW) — patients who can or will be able to do some ambulatory activities independently or with a minimum of assistance, but will require a wheelchair for the greater portion of their daily activities, and (5) *predominantly custodial* (PC) — patients who may be able to sit in a wheelchair or even stand upright in braces and with crutches for physiological reasons, but who are completely dependent upon attendant care for help in most or all daily activities, and will remain so.

It is emphasized, that the placing of a patient in one of these categories is meant as a guide to treatment and is not to be construed as being a permanent, fixed prognosis. During the stay of a patient in the hospital his category may be changed from "W" to "PW" (rarely does the patient whose original category is "PC" progress much beyond "W"). We are of the opinion that this type of classification is of definite value in grouping patients for therapeutic teaching, as well as assaying his present potential for the therapist. It is a motor estimate, which may be used by the therapist for determining a more accurate knowledge of the individual within the group.

It will be noted that the rehabilitation syllabus has been organized in units and elements. Since the unit involves considerable activity and individual participation in the group, a formal approach to handling the group will not succeed, and will probably decrease the effectiveness of activities presented. If the syllabus provides activity, then the method of presentation must allow for that activity. The best way to obtain the active participation outlined in the syllabus is through an informal and friendly approach which permits patients to exercise at their own pace, disregarding unified movements or strict cadences. The informal approach provides opportunity for individual group members to make progress consistent within their limitations. This is opposed to the formal approach which progresses the group

as a whole, as though each patient in the group had equal abilities and potentialities.

When planning a program and selecting activities, it is of vital importance that due consideration be given to the patient's physical limitations, as well as to choice of activities which will afford the patient a sense of achievement or improvement from day to day. After a few months in a hospital a patient can feel quite routinized, and it is essential that activities be planned so as to keep abreast of any improvement. This implies leaving an activity before it becomes monotonous to the individual. A varied program is essential, not only to avoid boredom, but positively to sustain interest. Since review is a part of all therapeutic teaching units, any points of finesse can be achieved later by practice, interspersed repetition, and re-emphasis.

Size of the Therapeutic Teaching Groups. — In the interest of an efficient program the classes are conducted in small homogeneous ability groups, with the activities for each group prescribed or approved by the physician in charge on the basis of personal needs. The *mat class* should be limited to a *maximum of eight to ten patients.* The functional activity groups such as parallel bar class, wheelchair class, etc., should be limited to a *maximum of six to eight patients.*

Conducting the Program. — In considering the problems of assuming the role of "therapist-teacher," and the actual teaching of the program, the physical therapist should not adhere to rigid rules of administering prescribed exercises and activities, but should *individualize* wherever possible. It is suggested that he employ the "explanation-demonstration-participation" method of teaching, if feasible, for any given situation. By this is meant that the therapist gives a brief verbal description and explanation of the exercise or activity to be taught, followed by a demonstration of the movements either by the therapist or some advanced patient within the group who has perfected the technique. When it comes to actual participation in the activity by the group, management can be placed on an individual or on a group performance basis. In other words, the activity may be such that it permits the entire group to perform the movements together, exercising at will (e. g., crutch balance, walking for endurance). On the other hand, the activity may be so complex or the safety factor so great (e. g., up and down stairs) as to require individual performance by one patient under the immediate supervision of the therapist while the other members of the group engage in preparatory or lead-up movements. Observation of patients during the practice period at the end of the treatment period will usually give the therapist clues as to which patients require more individual instruction the next day.

Advantages of Group Work

Other than administratively permitting sound therapy to relatively large case loads with limited personnel, group instruction is found to provide an "interest-method" of learning functional rehabilitation skills. Through socialization with other patients and the manifestations of mild, friendly rivalry with a neighbor which borders on emulation rather than competition, a large amount of recreational value is combined with therapeutic activities. We feel this has rewarded our hospital with an unusually high spirited morale among the patient population. Krusen[5] made a similar observation on a recent medical lecture tour of Europe when he reported a tendency in London

5. Krusen, Frank H.: Physical Medicine and Rehabilitation in Europe, Arch. Phys. Med. 32:10 (Jan.) 1951.

hospitals to group patients for class work in therapeutic exercises. He felt that the psychologic advantages in group exercises warranted the attention of American physicians and therapists to such procedures.

The variability, scope, and vigor of the functional activities program has been augmented many times over through the inception of therapeutic teaching. The way to master ambulation and daily activities essential to physical independence is through arduous practice and repetitious review of the basic elements or fundamentals of physical rehabilitation. Therapeutic teaching, which is based upon *instruction, practice, testing,* and *review,* affords the opportunity for supervised and repeated practice and review. Because of the facility in scheduling, patients can now receive as much as three, four, five or more varied treatments a day, if these are medically indicated and tolerated. In a strict, formal individual program with one therapist treating one patient, the patient would receive, crowded into a single treatment period, mat work, wheelchair activities, standing and ambulation, and functional activities.

Scheduling, which is a cooperative function among all the services required to treat the patient, is less a problem than it was before the introduction of therapeutic teaching. Group work permits greater utilization of the patient's available time, to the extent of individual needs and capabilities, for treatment and rehabilitation in physical therapy. For example our rehabilitation schedule provides four therapeutic teaching classes for each level of progression, which is ample for our present programming needs. So, if it is impossible to schedule a patient at one particular time for an activity, we have three alternative periods to consider.

Disadvantages of Group Work

Admittedly, the greatest disadvantage of therapeutic teaching is the reduction of individual attention in the administration of therapy. However, in terms of the over-all physical rehabilitation program, this is not so great that it outweights the advantages. The point of view of Ross[6] seems eminently sound when he said, "while all learning is individual learning, it can take place in a group setting; for the individual not only learns *in* the group, he learns *from* the group as well."

While we emphasize therapeutic teaching as one kind of group organization which provides for individual learning, we consider it only an adjunct method. We do not mean to imply that therapeutic teaching supersedes individual programs. At the New York State Rehabilitation Hospital, patients who are too severely involved to fit into any of the groups are treated entirely on an individual basis. Others are treated individually until such time as it is medically indicated that they can progress to therapeutic teaching levels. By constant testing and reevaluation of the patient, physical experiences can be well guided, assuring a proper balance in development and skill, thus offsetting, to an extent, the one big disadvantage of group instruction.

Summary

Simply stated, therapeutic teaching is defined as group procedures in physical therapy and rehabilitation. Planning is essential if therapeutic teaching programs are to function in accord with sound physiological and

6. Ross, C. C.: Measurement in Today Schools, Prentice-Hall, Inc., New York, 1947.

psychological principles. This entails the use of a rehabilitation syllabus (long term program) and daily treatment plans (immediate programs). Properly prescribed and administered, therapeutic teaching can be a successful method of attaining levels of proficiency in rehabilitation fundamentals, as well as a means of maintaining acquired skills.

Discussion

Dr. Harry Kessler (Washington, D. C.): This presentation is most pertinent and timely as a consideration of the increasing demands upon a professional technical group which cannot now nor for many years to come make available the number of adequately trained physical therapists required to fully meet the needs.

Please note that the authors have emphasized the fact that the activities outlined should not be construed as the answer to the problem of the overloaded clinic under all circumstances. There has been presented, however, a manner of approach which, intelligently applied under appropriate circumstances, may do much to alleviate the strain created by a disproportion between work load and available physical therapists.

Obviously, the large general hospital, with its diversification in types of patient under treatment, may not lend itself so readily to this method of approach; yet even here the exercise of imagination and ingenuity may serve to group certain classes of patients in the manner outlined.

The authors recognize the difficulty entailed by the lack of complete individualization of the treatment under these circumstances. However, with the proper approach to the patient on the part of the therapist, a factor which is extremely important under any circumstances and even more so in this situation, and with the careful selection of patients for specific groupings, this difficulty may be minimized.

I should like to mention that we in the Veterans Administration, in many instances, at least, have partially solved the problem of the overtaxed physical therapy clinic by full utilization of the abilities of the corrective therapists. In my own experience, and in the experience of others, the results achieved by these therapists have been most gratifying, and have broadened the scope of available therapy over and beyond what would have been possible if we had to depend solely on the number of physical therapists at our command. Even so, we have been faced frequently with the need for group approach in therapeutic procedures and at times advantageously so when re-socialization became one of the objectives.

RESISTIVE EXERCISES IN THE TREATMENT OF POLIOMYELITIS *

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It is evident that the goal in rehabilitating the post-acute poliomyelitis patient is realization of maximum residual capacity. It is equally obvious that to attain this goal there should be a well defined program leading up to actual training in functional activities. When the patient is left with definite muscular weakness, a system of exercises should be established that will gradually recover all remaining strength possible. The most efficient method known today for strengthening weakened muscles is progressive resistance exercise. This presentation will attempt to point out the relative importance of progressive exercises throughout the treatment program of the poliomyelitis patient with residual weakness, following the acute episode.

In the post-acute and occasionally during the acute period the therapist will administer passive exercises; this is primarily a mobilization procedure. At some subsequent time she will call upon the patient to help her move the affected part through a painless range of motion and should a contraction be elicited while moving through the desired range assistive exercise will have been initiated. In early assistive exercises or muscle re-education, the therapist will gauge the tempo of the assistive exercise so that the contraction will be sustained throughout the range. There must be perfect cooperation and coordination between the patient and therapist. Should the tempo be too fast there would be little or no load involved and consequently the elements of exercise will be lost; should the tempo be too slow, an overload would be established which will discourage the contraction and may well encourage incoordination. The result in this type of manual exercise will depend directly upon the skill of the therapist. With proper technique she not only will develop coordination, which is of primary concern, but will also increase the strength in the exercised muscle groups. The gain in strength is accomplished by gradually and progressively offering less assistance over a period of time. This is a manual application of progressive resistance exercises.

When coordination has been well established there are more efficient methods available to carry on and concentrate on progressive resistance exercises. These include the use of weights and counter balances,[1-2] and underwater resistance exercises.[3] If a pool is available both methods can be used. Generally it is more efficient and effective to exercise muscle groups less than "fair" in a water medium, while heavy resistance is better employed through utilization of weights. The most important factor in determining the choice in any instance is the skill of the operator in utilizing the method.

In prescribing progressive exercises for specific muscle groups it is important to concentrate on activities that will contribute the most toward maximal function. In this respect, important units in the lower extremities are the large weight-bearings groups. In the upper extremities, the hand

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1. De Lorme, T. L.: Restoration of Muscle Power by Heavy Resistance Exercise, J. Bone & Joint Surgery 27:664, 1945.

2. De Lorme, T. L., and Watkins, A. L.: Techniques of Progressive Resistance Exercises, Arch. Phys. Med. 29:263, 1948.

3. Schram, D. A., and Bennett, R. L.: Underwater Resistance Exercises, Arch. Phys. Med. 32:322, 1951.

is of primary concern, followed by shoulders and body elevators. In the trunk, the lateral abdominals and quadratii are important especially for balance and gait. It should be emphasized that in selecting the muscle groups for exercise one should choose those that have a residual weakness but present possibilities for some degree of return to functional strength.

It will be found after a variable period of time that the gain in strength

Fig. 1. — Spring Unit illustrated is from that used for the carriage return on an Underwood typewriter. A housing is applied over the unit and a crank handle is welded to the adjustment screw. There is no significant variation in tension throughout the useful range. A fish scale or a more accurate type of force indicator mechanism can be used to check actual tension for case records.

in the specific muscles exercised on a Progressive Resistive Exercises program will gradually decrease. This "leveling off" of return of strength is an indication for a change in the program.

Whereas the emphasis heretofore has been on individual units, the objective now becomes the performance of specific useful acts, utilizing all groups concerned in the functional exercise. In this part of the program, the patient may need braces and support for protection and stabilization as well as for assistance in function. In some specific instances it is possbile to use special apparatus which will assist in the performance of a functional ac-

tivity. An example of an assistive device for the abductors of the upper extremities is overhead slings with an adjustable coiled spring (Fig. 1). The tension is adjusted for assistance to do a functional act in abduction. As the abductors gain in strength, the tension in the spring is gradually decreased.

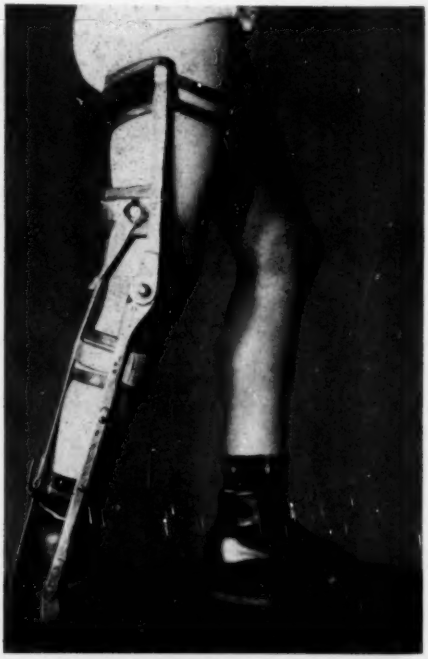

Fig. 2. — One-half inch elastic band is attached from mid thigh band to heel. Tension is created when leg is extended and pushing off in the stance phase. During the swing phase the knee flexes, causing release of tension, so foot can clear the floor in normal fashion.

In the lower extremities a good example of assistance is a gastroc-soleus band attachment on a long leg brace (Fig. 2). Here the assistance is created each time the patient extends his leg to push off. Adjustments can be made at the attachment in the heel, and tension on the elastic band can gradually be decreased. It is generally found, however, that the elasticity lost in regular use is sufficient to compensate for a gradual progressive decrease in assistance.

Another example is the short leg brace (Fig. 3) to assist non-functional dorsi-flexors of the foot. Leaves of spring steel that support the foot can be removed one at a time as the strength in the dorsi-flexors increases.

The amount of activity should be well graduated when using assistive

devices in the functional program. The reserve strength, especially endurance, is relatively small in muscle groups weakened by poliomyelitis. Any weight-bearing group in the leg that has slightly better than functional strength will perform adequately for short periods only. If the optimum amount of walking for the specific case is exceeded, a limp will appear, in which case either the walking distance should be decreased or the assistive force increased.

Fig. 2. — Commercial short-leg brace showing leaves of spring steel in posterior region near ankle. Good lateral stability is necessary with this type of brace, and it is not practical for children or others who will exert more than a moderate amount of stress in daily usage.

Conclusion

A concept has been presented that suggests three principal phases in an exercise program in post-acute poliomyelitis. Progressive Resistance Exercises are an integral part of this program with a minor emphasis on the early and final periods, and primarily emphasis on the intervening phase.

FUNCTIONAL SHOULDER AND UPPER EXTREMITY BRACE-APPARATUS

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BATON ROUGE, LOUISIANA

Shoulder disabilities, very common in many classes of medical practice, represent a high percentage of the cases referred to Physical Medicine and Rehabilitation. As a large number of these cases are ambulatory, it appears necessary to revise the usual methods of treatment. The goal desired was support in the most advantageous position, with gravity eliminated as much as possible, and the brace apparatus so designed that active and passive motion in all directions could be obtained with the least possible muscular effort. The brace apparatus described in this paper was developed, and it is believed that it can be gradually improved to provide the necessary requisites.

It is possible that the brace apparatus can be used with beneficial results in a large group of shoulder disabilities where the residual disability, regardless of original etiology, is so often caused or aggravated by the gravity — position drag upon the shoulder joint structures, articular surfaces, capsules, bursae, tendons, muscles, nerves, and blood vessels. The two most important requisites are support and motion with minimum effort. These requisites must include: (1) counteraction of gravity; (2) maintenance of advantageous position; (3) facilitation of natural functional motions, with return to original position; (4) light weight, supported on the pelvis (to prevent scoliosis when used unilaterally); (5) minimal mechanical resistance to minimal muscular force; (6) the facilitation of the use of passive swing-motion exercise.

Specifications

A plaster-mold form is first made for use in constructing the brace apparatus. A weight bearing pelvic band is formed to fit snugly over the crest of the ilium. A chest band is then formed. The bands are made of 24 surface tension (0.064 thickness) alloy aluminum, lined with felt and covered with Kalistron (washable plastic). The two are connected with a mid-axillary side bar of 24 surface tension alloy aluminum (⅝ inch width and 3/16 inch thickness). Webbing straps are attached to each — one around body, one from chest band over opposite shoulder. An over-shoulder aluminum strap is then molded to clear the disabled shoulder about ½ inch and sufficiently away from the body to clear body movements. It is made of 24 surface tension half-round alloy aluminum and attached to chest band by rivets in such a manner that the strap is just medial to the center of the shoulder joint, at which point a hole is drilled to receive the end of a 2½ to 3 inch steel tubing, the diameter of the tubing being dependent upon the weight to be supported — usually ¼ inch up. Before insertion a small section of steel strap is welded to the end of the tubing, the strap is bent to conform with the shape of shoulder strap and after insertion of the tubing the two straps are riveted together so that the tubing is perpendicular to the floor. A stainless steel rod (¼ inch or up) is bent at right angles; one end of the rod is cut to be inserted to rest upon the bottom of the tubing with sufficient length to clear the top of the tubing; the rod is then cut at arm length, where a polycentric or single hinged stainless steel joint is made for the elbow. Sufficient rod (maybe of

smaller diameter) is then attached to over-reach the wrist slightly. Springs of sufficient length and strength to overcome gravity and yet give ample functional stretch to the arc supported are attached to the arm and forearm rods. The springs are attached to perforated leather cuffs for support of the arm and forearm, and a felt ring with thumb and dorsal eyelets work well for two functional positions of hand support. In making the springs music steel wire is used (size 18 gauge and up), the length and diameter of the spring depending upon the amount of motion desired; the gauge by the weight to be supported. Various spring attachments are used to give full and free motion, yet supply adequate elbow flexion and counterflexion. They may be crossed from upper forearm to lower arm when more flexion is desired. The amount of arm abduction needed will depend on the condition to be treated; generally, about sixty degrees is preferred. The springs are attached to the rods by drilled holes or soldered and to the cuffs by eyelets; they may be electroplated after proper fitting is accomplished. Button holes

Fig. 1. — Bilateral Brace Apparatus for Poliomyelitic Paralysis of Both Upper Extremities. *Comment:* This white male, aged 26, contracted poliomyelitis August 17, 1951, and was admitted to our hospital September 6, 1951. He showed only fair response to muscle re-education up until the time the bilateral shoulder splint brace was applied at which time he was discharged and reported back at intervals. Muscle function tests made at end of one and two months showed remarkable improvement in function, and he was able to return to work as chemist at the end of six weeks. At the end of two months he was able to do full time work which required overhead reaching of both extremities in removing and replacing chemical bottles from high shelves. While his deltoids have only reached fair plus level of function the other muscles of the upper extremities rate good and good plus.

Fig. 2. — Unilateral Brace Apparatus for White Female with Paralysis of Left Upper Extremity. *Comment:* This white female, age eight, had onset of poliomyelitis May 29, 1951. After recovery of the acute stage she had fair minus function of trapezius, serratus magnus, rhomboids, and lattissimmus dorsi, and the remainder of the muscles only showing zero to trace with the exception of the flexor profundis and sublimis digitorum showing poor function. The functional shoulder splint was applied to the left upper extremity on October 5, 1951. She has shown slow but gradual improvement. Muscles of the arm have improved slightly, and muscles of the forearm and hand have shown remarkable increase from zero and trace to poor and poor plus. Functional use good.

may be made in clothing which will allow it to be slipped on over the tubing. When needed for both upper extremities, the bands are continued posteriorly and a hinged joint connection is made. The brace apparatus then can be slipped on as a vest. For small narrow width shoulders, it may be advantageous to use a small length tubing and make a double bend offset in the arm rod so as to clear head movements.

Uses

Properly fitted, this unilateral brace apparatus should not disturb even the polio-weakened backs. Very little muscle power is needed to motivate the ordinary functional movements. Walking will be accompanied by vertical swinging motion. The extremity or extremities may be folded compactly

for passing through narrow openings. Various modifications will be found necessary: for example, in very small children where the springs are not feasible, the tubing hinge is mounted on the side bar or corset crutch bar, the elbow hinged and hand supports used. It may be necessary to limit the extension movement of the shoulder or elbow. This may be done with a leather tubing check across the angle. Likewise, if flexion needs restriction, a wooden stick of desired length can be inserted in the leather tubing. In using the brace apparatus it is suggested that the device be kept on for gradually increasing intervals during the first week.

Based on the findings so ably brought out by Yamshon:[1]

> "Spasticity in the muscles of the arm is influenced primarily by the position of that arm. It can be demonstrated that the spasticity can shift from the flexors to the extensors, when the relationship to each other of the muscles around the shoulder girdle is altered. All other reflex influences, in the hemiplegic man at least, are superimposed upon this primary postural pattern. When the arm is at the side, the increased tone is found in the flexors. If the arm is elevated to 90 degrees or above, it can be noted that the tone will shift from the flexors to the extensors."

It is believed that, supporting the arm in the brace apparatus at about sixty degrees abduction, this reflex spastic contraction can be reduced to a minimum by placing the shoulder muscles in better relation to each other; by eliminating stretching of tendons, muscles, nerves, and blood vessels through a narrowed rigid opening; and by permitting active, passive, and spring-motion exercise. These would reduce reflex irritation (sympathetic stimulation) and give better blood supply and muscle tone, thereby hastening the return to voluntary control with increased abduction and external rotation.

The brace has only been in use for a short period, and, as yet, only on poliomyelitic paralysis cases. The results thus far have been very encouraging, especially, where groups of shoulder muscles had remained static for some time. In a joint where stability is sacrificed for mobility, it is believed the brace apparatus can be used beneficially in all forms of shoulder disabilities, where functional support, active and passive exercise, abduction, and external rotation are needed.

It has been found to greatly accelerate functional recovery in poliomyelitic paralysis of the shoulder where the patients are not bedridden. Where the shoulder is practically flail, it may be necessary to add two guy straps to aid in holding the head of the humerus well in the glenoid fossa. After a short period these straps have been discarded. The brace apparatus has been found very beneficial in cases of flail shoulder with a functioning forearm or hand — enabling performance of good functional movements. Every one is familiar with the benefits derived from the overhead spring suspension supports attached to the back of a wheel chair. This brace apparatus can also be used in ambulatory cases and will give more definite support and more normal functional motion. Although it is still in the experimental stage, it is hoped that the brace apparatus will contribute to the development of better functional bracing for disabilities of the shoulder and upper extremity.

1. Yamshon: "Position of the Arm in Spastic Hemiplegia," Arch. Phys. Med. 31:655, 1950.

Acknowledgment. — The author wishes to express most sincere appreciation and thanks to Mr. George Lambert of Snell's Limbs and Braces, Inc., of this city for his assistance and cooperation in the development of this brace apparatus.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

Personals

Dr. **George D. Wilson,** Asheville, N. C., recently received an Award of Merit from The Citizens Committee for the Hoover Report. Dr. Wilson was Chairman of the Section on Physical Medicine, Advisory Board of The National Doctors Committee, an affiliate of The Citizens Committee.

Park A. Deckard, Harrisburg, Pa., has recently retired from the staff of Harrisburg Hospital. He will remain as a consultant of the hospital and will continue his private practice.

At the Kessler Institute for Rehabilitation, West Orange, N. J., a conference on the rehabilitation of paraplegics will be held on October 10. Dr. **Arthur S. Abramson** will act as Secretary of the Neurology panel, while Dr. **Howard A. Rusk** will be Chairman of the panel on Rehabilitation and Physical Medicine.

Dr. **Michael M. Dacso,** New York, has been appointed to serve on the National Committee on the Aging and also on the Executive Planning Board of the Division of Welfare of the Aged, Welfare and Health Council of New York.

Scholarship

The National Society for Crippled Children and Adults and Kappa Delta Phi, professional education fraternity, have awarded a scholarship of $1,000 for graduate training at the School of Social Service Administration, University of Chicago. A qualified student desiring to specialize in the rehabilitation of the crippled will be eligible for the scholarship. Applicants must hold a bachelor's degree and have completed at least one year of professional education in an accredited school of social work. Additional information may be obtained from the National Society for Crippled Children and Adults, 11 S. La Salle St., Chicago 3, Ill.

University of Michigan Physical Therapy Program

Information has been received that the University of Michigan is planning a program in physical therapy, leading either to the degree of Bachelor of Science in Physical Therapy or a Certificate in Physical Therapy. The first class will be admitted in September, 1952. Write direct to the University for details.

Six Medical Schools Approve Resolution

Six medical schools of Pennsylvania have made favorable reply to a resolution approved by the House of Delegates of The Medical Society of the State of Pennsylvania recommending the establishment of departments of Physical Medicine and Rehabilitation at the undergraduate and graduate level.

The University of Pennsylvania, Temple University School of Medicine, Woman's Medical College of Pennsylvania, Jefferson Medical College, Hahnemann Medical College and the University of Pittsburgh School of Medicine have all agreed to review their curriculum and institute this subject in their schedules.

This is an important step forward in the recognition of Physical Medicine and Rehabilitation as a specialty since doctors themselves have recognized the great need for graduate and undergraduate instruction in Physical Medicine and Rehabilitation.

Dr. Albert A. Martucci, of Philadelphia, is chairman of the Commission of Physical Medicine and Rehabilitation, which presented the resolution before the House of Delegates. Drs. Guy H. McKinstry, of Washington, and Pascal F. Lucchesi, of Philadelphia, read the resolution into the records during the last annual session of The Medical Society of the State of Pennsylvania.

Section on Physical Medicine and Rehabilitation, A. M. A.

The following officers have been elected for the 1952-53 period: Chairman, Kristian G. Hansson, New York; Secretary, Walter J. Zeiter, Cleveland.

Adopt New Method of Artificial Respiration

The Surf Life Saving Association of Australia officially adopted the "push-pull" Holger Nielsen method of artificial respiration at its annual meeting in June. The report of the Council on Physical Medicine and Rehabilitation on the method assisted the association in arriving at its decision.

New Unit at University of Illinois

Construction has been started on a new classroom and laboratory building in the Medical Center District to permit the colleges of medicine, pharmacy, and dentistry to increase their enrollments.

(*Medical News Continued on Page 559*)

ARCHIVES of PHYSICAL MEDICINE

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

∴ EDITORIALS ∴

A NEW APPROACH TO AN OLD PROBLEM

The statement is often made that physical medicine is applied physiology. This, of course, is only partially true, since chemistry, physics, anatomy, and the other fundamental sciences each plays a role. Nevertheless, physiology is exceedingly important in physical medicine. This is well illustrated by Kabat's article in this isue of the ARCHIVES, one of a series on the general topic "Studies on Neuromuscular Dysfunction."[1] The title of the present paper is "The Role of Central Facilitation in Restoration of Motor Function in Paralysis."

The author first presents the physiological background laid by such men as Sherrington, Fulton, and Gellhorn as well as by himself. He then describes techniques for obtaining maximal excitation of anterior horn cells through central facilitation. This may be accomplished by (1) Maximal resistance. (2) Stretch, (3) Mass movement patterns, (4) Reflexes, and (5) Reversal of antagonists. These methods have been used successfully by Kabat and his associates at the Kabat-Kaiser Institute in various types of paralysis on a scale which leaves little doubt of their effectiveness.

The usual cautious use of passive motion, assistive motion, free motion with and without gravity eliminated, and, finally, resistive motion has been discarded by the author in the treatment of the paralyses. He starts with maximal resistance from the beginning. Instead of the painstaking reeducation of isolated muscles, he uses mass movement of whole muscle groups. Instead of concern about the danger of over-stretching paralyzed muscles, he purposely employs stretch as a therapeutic method. Instead of attempting to avoid fatigue, the author advocates giving the patient several hours of activity daily. This is indeed a radical departure from generally accepted procedure, yet when one follows the author's reasoning, it does not appear so.

Kabat makes use of certain reflexes to enhance the central facilitation effect, for example, the tonic neck reflex of Magnus, the postural reflexes, and the righting reflexes. The last device mentioned is the rapidly alternating contraction of antagonistic muscle groups. This may be accomplished by rhythmic stabilization, the rapid alternating isometric contraction of antagonists against resistance; by the isometric reversal of antagonists, by the isotonic reversal of antagonists with isometric contraction; or by the quick reversal of antagonists. These techniques aim to produce, by means of proprioceptive impulses, central facilitation of anterior horn cells and hence maximal stimulation of the involved muscles through their motor nerve supply.

The reader is advised to read this paper in detail as well as the rest of the author's contributions on this topic. They are stimulating and thought provoking.

1. Kabat, Herman: Studies on Neuromuscular Dysfunction, Arch. Phys. Med. 33:521.

STATE REGISTRATION OF PHYSICAL THERAPISTS

There appeared in the May, 1952, issue of the Physical Therapy Review[1] a resumé of the present status of the local registration of physical therapists by state examining and licensing bodies. At the present time 15 states and the Territory of Hawaii have enacted legislation pertaining to this matter. These are: Arizona, Connecticut, Florida, Georgia, Illinois, Maryland, Massachusetts, Minnesota, New Hampshire, New Mexico, New York, North Carolina, Pennsylvania, South Carolina, and the Territory of Hawaii. Similar legislation is under consideration in California, District of Columbia, Kentucky, New Jersey, Tennessee, and Wisconsin.

In the states of Arizona, Maryland, New Mexico, New York, and Pennsylvania practice of physical therapy without a state license is prohibited. In other states the use of the title Registered Physical Therapist, or any similar term, by those not registered is prohibited, although practice is not. It would appear at once that such legislation as this would not accomplish a great deal toward raising the standards of physical therapy practice. It is, however, probably the best that can be accomplished in situations where there is great opposition from irregular groups. It is likely to be a choice between such legislation and a law with a "grandfather clause" which blankets in everyone who has practiced any brand of physical therapy in the state for a year or more.

The method of licensing varies considerably in the different states. In some, graduates of schools approved by the Council on Medical Education and Hospitals of the American Medical Association are licensed without examination. In others, registrants of the American Registry of Physical Therapists, and/or members of the American Physical Therapy Association are also licensed without examination; and in still others all applicants must submit to examination. Most of the examinations are given under the direction of the State Board of Medical Examiners or some similar body assisted by qualified physical therapists. Examination fees vary from $5.00 in New Hampshire to $30.00 in New York. Annual fees vary from $1.00 to $5.00. Reciprocity is available in most states for fees ranging from $5.00 to $25.00.

Most of the licensing laws stipulate that the physical therapist must practice only on the prescription and under the direct supervision of doctors licensed to practice medicine and surgery. This is as it should be, since physical therapy is auxillary to medicine and surgery. Qualified physical therapists do not wish any other arrangement.

State licensing gives legal status to the practice of physical therapy, but it also adds another fee to the budget of the therapist. If the physical therapist belongs to the American Registry, and the American Physical Therapy Association and has to pay a state license fee, the annual expense approaches $20.00 to $25.00. Fortunately, most of the state fees are nominal, but some appear unreasonably high.

State licensing of physical therapists is spreading and seems to be here to stay. If it helps to raise and maintain high standards of practice in this field, it is commendable. If it simply legalizes practice by the incompetent and the inadequately trained, it is not commendable and will do positive harm. Up to the present time, laws enacted have, in general, been fairly satisfactory.

1. State Registration of Physical Therapists, Phys. Ther. Review, Vol. 32, pp. 256-161 (May) 1952.

Medical News
(Continued from Page 556)

Rehabilitation Film

The film "A New Beginning," presented by the U. S. Army with cooperation of the Institute of Physical Medicine and Rehabilitation may be purchased from the United World Films, Inc., 1445 Park Ave., New York 29, N. Y. It will prove of interest to any adult who is not familiar with the advantages of physical medicine and rehabilitation.

Film Strips Available

The following film strips may be obtained by writing to Filmstrips, Inc., 140 W. 86th St., New York, N. Y.: "Crutchwalking," "Use of the Wheelchair," "Bed Exercises," and "Mat Exercises."

The Institute of Physical Medicine and Rehabilitation, 400 E. 34th St., New York 16, N. Y., has available "She Can Do It Herself: Paraplegic Homemaking," and "She Can Do It Herself: Polio Homemaking."

Write to the above organizations for additional information.

Movie on Cerebral Palsy

Dr. George Deaver is Technical Adviser of a 16 mm., color, sound movie on Cerebral Palsy Methods of Ambulation. It may be purchased from the New York State Association for Crippled Children, 257 Fourth St., New York, N. Y., or loaned from the National Society for Crippled Children and Adults, 11 S. La Salle St., Chicago 3, Ill.

Chicago Medical School Gift

The Chicago Medical School was recently presented with a check in the amount of $7,500 by the Faculty Wives' Association. The money will be used for scholarships and research.

Physical Therapy Manufacturers Association

The following officers were elected for the 1952-53 season: Chairman, Theodore T. Blumberg, M.D., Liebel-Flarsheim Co., Cincinnati, Ohio; Vice-Chairman, Oscar Dallons, Dallons Laboratories, Los Angeles, Calif.; Secretary, A. W. Anderson, Burdick Corporation, Milton, Wis., and Treasurer, A. L. Schwieckart, Hanovia Chemical and Mfg. Co., Newark, N. J.

Polio Grant

Washington University School of Medicine, St. Louis, Mo., was recently awarded a grant of $7,669 for continuation of the teaching and service programs of the division of physical medicine.

Recognition for Clinic

Laurel Hospital and Clinic at Laurel Run in Pennsylvania has been admitted to membership in the American Hospital Association, the Pennsylvania Hospital Association and has been approved by the American Medical Association. The institution was established last year by Dr. Nicholas Mauriello. In addition to being a member of the Congress, Dr. Mauriello is a member of the American Society of Physical Medicine and Rehabilitation and a diplomate of the American Board of Physical Medicine and Rehabilitation.

Daniel Institute, Inc.

Earle H. Daniel, a contributor to the ARCHIVES OF PHYSICAL MEDICINE, has recently opened the Daniel Institute of Prosthetics Service and Rehabilitation, 619-21 W. Broward Blvd., Fort Lauderdale, Fla. Dr. Harriett Gillette, a Congress member, is Chief Consultant of Physical Medicine. Among the activities are proper evaluation, prescription and fitting of devices, limbs, and gadgets to assist patients referred to the Institute in regaining the use of defective limbs and proper use of artificial limbs. For additional information, write direct to Mr. Daniel, Director.

Seminar in Physical Rehabilitation Methods for Nurses

The Institute of Physical Medicine and Rehabilitation, New York, N. Y., is offering a three-week seminar designed for registered nurses in hospitals as well as in the Public Health fields. Among the instructors are Doctors Howard A. Rusk, George G. Deaver, and Donald A. Covalt. Dates are Dec. 1-19, 1952; March 2-20, 1953, and May 18-June 5, 1953. Applications and requests for additional information should be directed to Miss Edith Buchwald, Director of Rehabilitation Courses for Physical Therapists, Institute of Physical Medicine and Rehabilitation, 400 E. 34th St., New York, N. Y.

Postgraduate Courses Offered in Physical Medicine and Rehabilitation

The following institutions are conducting postgraduate courses in physical medicine: College of Medical Evangelists, Oct. 1-Nov. 19; Office of the Surgeon General, Educational and Training Div., Washington, D. C., Oct. 1-3; Graduate School of Medicine, University of Pennsylvania, Sept. 29, 1952, to May 23, 1953, and June 16-27, 1953. Postgraduate courses in Physical Medicine and Rehabilitation are being offered by New York Polyclinic Medical School and Hospital, arranged, 4 weeks, part time, New York University Post-Graduate Medical School, 5 courses (write for details).

Accepted Apparatus

Batrow Neuromuscular Stimulator, Model B. — Manufactured by Batrow Laboratories, Inc., R. F. D. 1, Branford, Conn., device generates condenser discharges. It was found the instrument has merit in electrotherapy as a neuromuscular stimulator, but only for muscles possessing a normal nerve supply. No evidence was found that the device was useful for diagnostic purposes or for stimulation of paralyzed muscles. The Council on Physical Medicine and Rehabilitation voted to include the apparatus in its accepted list.

Newly Registered Therapists

July 16, 1952

Allott, Nancy Eleanor, 296 Grand St., Newburgh, N. Y.

Alvord, Lucille Eileen, 55 Herrick Rd., Newton Centre 59, Mass.

Austin, Mary Ann, 114 Observatory St., Bennington, Vt.

Barclay, Claire Jean, 60 Berkeley St., Barre, Vt.

Becker, Barbara Violet, R. R. No. 2, Box 118, Barrington, Ill.

Bonisteel, Marian Elizabeth, 565 Cumberland Ave., Syracuse, N. Y.

Chadwick, Norma Rice, 7 Garfield Ave., Hamden, Conn.

Cody, Anne, Canton Ave., Milton, Mass.

Craig, Charlotte D'Artenay, 700 Gordon, Reno, Nev.

Dias, Carol Mary, 42 Amory St., Cambridge, Mass.

Ferron, June Frances, 1105 N. E. 117th St., Miami, Fla.

Greene, Norman Charles, 314 N. Blue, Walla Walla, Wash.

Griswold, Joan McLane, Box 85, The Willows, Old Lyme, Conn.

Hahn, Maurice Griffith, 301 Thomas Apts., Minot, N. Dak.

Herwig, Gordon Evans, 1908 State St., Santa Barbara, Calif.

Hirsh, Nancy Lee, 720 Ft. Washington Ave., New York 33, N. Y.

Hofmann, Warren Henry, 1466 Bellevue Ave., Burlingame, Calif.

Hubbuch, Margaret Caroline, 574 S. Crest Rd., Chattanooga 4, Pa.

Kaiser, Barbara Marie, 39 Munsel Dr., Cranford, N. J.

Lewis, Joanne, 640 Beverly Rd., Mt. Lebanon, Pittsburgh 16, Pa.

Lueke, Dorothy Ellen, 1620 N. 52nd St., Seattle, Wash.

McFarlane, Margaret, Rt. No. 2, Box 337, Tigard, Ore.

Moore, Mary Ellen, 14 Green Hill Rd., North Haven, Conn.

Muratore, Rose M., 88 Columbia St., Meriden, Conn.

Murphy, M. Jean, 65 Bird St., Dorchester 25, Mass.

Nelson, Harriette Elaine, 1519 Del Rosa Ave., San Bernardino, Calif.

Quinn, Joan Frances, 57 Linden St., Fall River, Mass.

Rathjen, Edward Jerome, 1430 Yosemite St., San Jose, Calif.

Richardson, Carol Ann, 4700 Alpine Rd., Redwood City, Calif.

Saunders, Roy Holman, 718 S. Sherman St., Denver, Colo.

Scott, Ralph Allen, 33 E. High St., Plymouth, Ohio.

Seely, Susanne Warner, 2171 Middlefield Rd., Cleveland Heights, 6, Ohio.

Shelton, Kenneth, 1301 Waldrip St., Elma, Wash.

Smolak, Anna Jane, 40 W. Spring St., Somerville, New Jersey.

Stearns, Barbara Jean, 198 Maplewood St., Watertown 72, Wash.

Wilcox, Lois Irene, 50 W. Blackwell St., Dover, N. J.

July 23, 1952

Campbell, Donald S., 5541 36th Ave., S., Minneapolis, Minn.

Dahlgren, Dean R., 2165-H Hoyt Ave., W., St. Paul, Minn.

Gostick, Glenn F., 422 Russell Ave., N., Minneapolis, Minn

Grabner, Mary J., 630 S. E. 7th St., Minneapolis 14, Minn.

Kasinkus, William, 310 12th Ave., S. E., Minneapolis 14, Minn.

Klein, Frank J., 301 Wildwood Ave., Birchwood, White Bear Lake 10, Minn.

Kleinschmidt, Joan, 1026 Carney Ave., Mankato, Minn.

Lindquist, Wernette B., 3241 Twin Lake Rd., St. Paul 6, Minn.

McQuillan, Patricia A., Rt. 9, White Bear Branch, St. Paul 10, Minn.

Moen, Wilbur L., Box 71, Upham, North Dakota.

Mundale, Martin O., 689 22nd Ave., N. E., Minneapolis, Minn.

Pohtilla, James F., 3525 3rd Ave., W., Hibbing, Minn.

Powell, Nadine, 200 12th Ave., S. E., Minneapolis, Minn.

Wessels, Geraldine G., Raymond, Minn.

Westrem, Douglas J., 35½ Luverne S., Minneapolis 19, Minn.

Wuolet, Margaret J., 2118 Glenwood, Minneapolis 5, Minn.

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine.

ULTRAVIOLET RADIATION. By *Lewis R. Koller*, Ph.D., Research Associate, General Electric Research Laboratory, Schenectady, New York. Cloth. Price, $6.50. Pp. 270 with illustrations. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, 1952.

The voluminous writings on the subject of ultraviolet radiation present a formidable task to any physician who would attempt to master the subject. However, this book presents the basic concepts of the subject, particularly in terms of the physical principles involved, in such a straight forward and clearly understandable manner as to bring an understanding of the basic physics of ultraviolet generators within the ability of the physician or other person with a serious interest in the subject.

The text is divided into eight chapters as follows: Introduction, Arcs, Incandescent Sources of Radiation, Solar Radiation, Transmission, Reflection, Some Applications and Effects of Ultraviolet, and Detectors of Ultraviolet Radiation. The illustrations, charts, tables, and graphs contribute enormously to the book's lucidity.

The author, fortunately, makes a mimmal attempt to present the more controversial aspects of the medical application of ultraviolet energy. This book will be of interest to anyone concerned with the subject of ultraviolet radiation and will be of special value to all physiatrists.

MENDERS OF THE MAIMED. The Anatomical and Physiological Principles Underlying the Treatment of Injuries to Muscles, Nerves, Bones and Joints. By *Sir Arthur Keith*, M.D. (Abdn.), F.R.C.S. (Eng.), LL.D. (Abdn.), F.R.S. Conservator of the Museum and Hunterian Professor, Royal College of Surgeons, England. Cloth. Price, $10.00. Pp. 335 with illustrations. J. B. Lippincott Co., East Washington Square, Philadelphia, Pa., 1952.

Here is a book that is a rare treat. Although written by an orthopedist and about the early orthopedists, particularly the English and French, it should be of greater appeal to physiatrists. Most of the book is concerned with the development and the use by these early orthopedists of rest, motion, massage, exercise, heat, cold, electricity and other measures now employed routinely in physical medicine.

It is fascinating and instructive to read about the discussions and opinions of these men who advocated physical measures many years ago. The great John Hunter showed profound respect for muscles — "He knew that a voluntary muscle was the most educable of all structures. By a repeated and judicious exercise of his will a patient may do more to help the recovery of muscular function than can be accomplished by the most complicated of gymnastic machines and of electric batteries." A lady who had lost the motion of her knee due to a fracture when advised to move the joint actively and concentrate on its movement secured good function, for he believed "if the influence of the mind were freely exerted on the muscle, it would gain this power of contraction," an idea that was thought to be original only a few years ago. Jean Pierre David also appreciated the purpose of active motion and the following quotation from his work, although made in the eighteenth century, is wisely followed today — "the machinery which can set the muscles to work lies in the patient's own nervous system. The only agency which can set the machinery in motion is the patient's own will. The sooner the patient ceases to rely on outside help, and the sooner he comes to realize the progress depends on his own efforts, the quicker and better will be the ultimate result."

An interesting chapter on "Movement as a Means of Treatment" considers the orthopedists in France, which the author describes as the cradle of orthopedic surgery, beginning with Nicholas Andry who published his work "Orthopedia" (a term which he coined), in 1741, continuing with such notable orthopedists as Delpech, Bonnet and others, and closing with the accomplishments of Lucas-Championniere who wrote the treatise on "Treatment of Fractures by Massage and Mobilization." This latter's well known quotation is as follows — "Massage allayed almost instantly the pain at the site of fracture; it accelerated the process of repair; it dissipated inflammation exudates, reducing swelling and tension in the damaged parts; it maintained muscles, nerves, tendons, ligaments, and joints in a state of health." An opinion that might be reviewed today since the therapeutic value of massage is being questioned.

The chapter about Duchenne of Boulogne is chiefly concerned with his contributions in the use of the faradic current for the treatment of chronic joint and muscular conditions and for its diagnostic purposes. The story is told of his difficulties with the physicians in Paris with his induction coil; fortunately by his patience and perseverance, and perhaps his personality described a "Don Quixote and Sancho Panza rolled into one," he was able eventually "to open the door to a new field of knowledge."

A most interesting chapter is entitled "The Introduction of Gymnastics and Massage to Surgery" which relates the influence of Jacques Delpech and his Gymnastic Institution which he established in Montpellier in 1825, John Shaw and the Windmill Street School in London and last but not least the "medical gymnastics" of Pehr Henrik Ling of Sweden.

These are merely a few examples of the contributions by orthopedists and others in advancing the field of physical medicine — numerous others might be included.

The following words on the fly leaf are worthy of quoting — "Every once in a while there comes along a project which makes the publisher feel that he is really contributing something through his chosen vocation. The opportunity to make available a classic work such as 'Keith's Menders of the Maimed' is something which brings pleasure and inspiration to publishing. It is a monumental piece of writing which surely reflects that rare combination of head, heart and hand. The book is for the few rather than for the many."

Only 1500 copies of this edition have been printed and are marked for distribution in the United States. It should be in the library of every physiatrist.

PHYSICAL REHABILITATION FOR DAILY LIVING. By *Edith Buchwald,* M.A., A.R.P.T., Director of Rehabilitation Courses for Physical Therapists, Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center. In collaboration with *Howard A. Rusk,* M.D., Professor and Chairman, Department of Physical Medicine and Rehabilitation; *George G. Deaver,* M.D., Professor of Clinical Physical Medicine and Rehabilitation; *Donald A. Covalt,* M.D., Associate Professor, Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center. Cloth. Price, $7.50. Pp. 183, with illustrations. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York, 1952.

A good sign of progress in the field of Physical Medicine and Rehabilitation is the appearance of new and excellent textbooks. In the past, knowledge about the techniques of teaching paraplegics how to develop independence in the acts of daily living, including dressing, toilet care, ambulation, and use of a wheelchair, could be gained only by training experience in the very limited number of centers doing this work. Now this splendid book makes it possible to give our student therapists a proper text from which to learn the basic techniques before their clinical practice, and it will also serve as a valuable reference during actual application. Because of its excellent and profuse photographic illustrations, it can be used by the neophyte therapist as a daily guide in planning a physical rehabilitation program for a patient much as the surgeon may study anatomical charts before the forthcoming operation. It should also be of benefit to the patients themselves, particularly if they do not have the opportunity to observe other more advanced patients in the treatment center.

The book is primarily devoted to the problem of the paraplegic and shows step by step his progress in developing skill in independent living, starting in bed, and continuing on the mat, in the wheelchair, on crutches, and on public transportation. This is done largely by photographs, but appropriate directions and precautions are outlined. Charts to measure progress are included, also chapters on apparatus. As the title indicates, only physical rehabilitation techniques are presented, not the general medical, psychological, social and economic problems of the paraplegics.

The book should be a required reference text for all physical therapy students, and should be in all physical medicine and rehabilitation libraries.

THE HOSPITAL PURCHASING FILE 1952. Twenty-ninth edition. Cloth. Price, $3.00. The Modern Hospital, 919 N. Michigan, Chicago 11, 1951.

This volume, like previous editions, is a ready reference for hospital purchasing agents and administrators of the sources of supplies. Last year's innovation, a check list and description of equipment for a new general hospital is continued; it will interest those responsible for established institutions as well as those contemplating new ones.

Specialized therapeutic, diagnostic and laboratory equipment, although an integral part of a modern hospital, is only cursorily covered, in part because the coverage reflects the advertisers in "Modern Hospital." In view of the imposing weight of the volume, perhaps the publishers might consider the advisability of establishing a supplement concerned with such items.

INTERNAL MEDICINE: ITS THEORY AND PRACTICE. By *John H. Musser,* B.S., M.D., F.A.C.P., Late Professor of Medicine in the Tulane University of Louisiana School of Medicine, New Orleans, La., and *Michael G. Wohl,* M.D., F.A.C.P., Assoc. Professor of Medicine, Temple University School of Medicine, Chief of Nutrition Clinic, Philadelphia General Hospital, Chief of Endocrine Clinic, Temple University Hospital. 80 Contributors. Fifth edition. Cloth. Price, $15.00. Pp. 1563 with 236 illustrations and 10 plates in color. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1951.

This text book, in general, is skillfully prepared and contains a vast amount of medical information, which is easily read and understandable. Many of the more recent advances in medicine have been included. The sections pertaining to geriatrics, medical genetics and psychosomatic medicine are welcome additions to a general medical text.

The sections pertaining to infectious, endocrine, cardiovascular, renal, locomotor, and nervous diseases are especially well-written by authorities well-known in their respective fields. A chapter on the principles of anti-microbial therapy deserves special mention. It is brief, concise, and clarifies the indication for various antibiotics and the basic mechanisms regarding their respective mode of action.

Illustrations, including both black and white and color photographs are adequate, except in the section pertaining to blood diseases, which could be improved with color photographs of blood dyscrasias.

The bibliographies contain numerous well-chosen articles, including many from the recent medical literature.

This book appears to be complete in most respects and therefore can be recommended as excellent basic text in general medicine.

THIS WILL KILL YOU. By *Charles Furcolowe.* Cloth. Price, $2.75. Pp. 190, with illustrations. B. C. Forbes & Sons Publishing Company, Inc., 80 Fifth Ave., New York, 1952.

This humorous book written by Charles Furcolowe is a pseudo-scientific volume in which he presents serious health hints in a comical fashion. The book was written under the critical supervision of a distinguished physician and the material is based on vital statistics and case histories.

The author satirizes in a humorous fashion the many habits of modern business men that lead him to an early grave. He discusses such interesting subjects as "How's Your Blood Pressure," "You, Too, Can Have an Ulcer," "The Smoke Eaters," "Exercise Is for Horses" and many other equally intriguing subjects in which facts are often exaggerated in order to emphasize the underlying advice. There are many humorous items and good laughs in this book and in many instances he startlingly depicts the many things we do in our daily lives that we know are or could be detrimental to our health.

DER ULTRASCHALL IN DER MEDICINE (Ultrasound in Medicine): Reports of the Erlangen Congress on Ultrasonics of 1949, and Transactions of Its Scientific Sessions. Volume I. Edited by *Prof. Dr. K Matthes,* Director of the University Medical Clinic, Erlangen, and *Prof. Dr. W. Rech,* Asst. Director of the University Medical Clinic, Erlangen, with assistance of *Dr. Wachsmann, Dr. Barth* and *Dr. Schoenefeldt.* Paper. Price, $7.25. Pp. 472, with 146 illustrations and 50 tables, 1949. Volume II. Progress in Biologic and Medical Research Contributed by the 1950 Ultrasonic Congress at Rome. Edited by *Kh. Woeber,* M.D., Bonn. With co-workers *O. Hug,* M.D., Frankfurt; *Dozent W. K. Keidel,* M.D., Erlangen, *H. Ladeburg,* M.D., Freiburg; *J. Lehmann,* M.D., Frankfurt; *R. Pohlman,* Ph.D., Zurich; *Prof. Dr. G. Schmidt,* Stuttgart; *F. Schwab,* M.D., Vienna; *K. Stuhlfauth,* M.D., Munich; *G. Veltman,* M.D., Bonn; *L. Wyt,* Vienna. Paper. Price, $1.20. Pp. 80, 1950. Volume III. Contributions to the Problem of Dosage Measurement and Dosage Techniques in Ultrasonic Therapy. Released in Association with the Society of Ultrasonic Research. Edited by *Karlheinz Woeber,* M.D., Bonn, in cooperation with 15 co-workers named in text. Paper. Price, $1.32. Pp. 90, with 27 illustrations and 3 tables, 1951. Published in association with the Society for the Study of Ultrasonics. S. Hirzel Verlag, Stuttgart.

These three volumes earnestly call our belated attention to a new therapeutic agent described as ultrasonics which promises to exert as prominent an influence in medicine as it has in the spheres of biology, chemistry and industrial pursuits. It claims our special interest through the eloquence of an exhaustive experience initiated by Pierre Curie in 1880, on a source of energy whose nature and characteristic were subsequently determined by reputable international workers to give us an orientation in the best tradition of modern research. The books represent the collective opinion of many hundred contributors and is supported by more than a thousand references in order to add to the validity of conclusions expressed in the recent Congress on ultrasonics at Erlangen and Rome by a representative body of organized physicians and scientists gathered to evaluate the mass of current experiences related to this field of practice. Of the 73 papers included in the first volume, each has its claim to distinction both by name of author and/or the distinguished association with a university background of historic tradition. Thus, whatever the subject or conclusion contributed it has as a basis for its acceptance the hall-mark of authority, giving this, the youngest of our healing methods, a hearing in equally representative circles in other lands.

The first of these monographs is as rich a source of original and confirmative information which virtually covers every essential facet of the physical and biochemical action of ultrasonics, its clinical applicabilities, techniques, and indication in medical practice. In content the text is supported by authorities whose names are widely quoted wherever ultrasonics is the topic of discussion, such as Schliephake the earliest of German pioneers, as well as Pohlman, Dussik, Buchtala, Hintzelman, Stuhlfauth, Barth, Demmel, Denier, Wachsmann, to mention a few who virtually represent the authoritative opinion on the subject. Throughout, the exposition is highly supported by quantitative proof in addition to illustrations and tabulated data, a rich bibliography and index. Its major limitation is purely of a linguistic nature which unfortunately is a handicap to the many to whom its reading would be a welcome education as an introduction to ultrasonics in medicine.

Volumes II and III are small monographs dealing with the advances of biochemistry applied to medicine through ultrasonics as presented at the International Ultrasonic Congress in 1950, at Rome, and with the problem of dosage control and its application to ultrasonic therapy, both under the editorship of Dr. Karheinz Woeber, and a long list of authoritative co-workers mentioned in the text. In each there is a quality of timeliness and substance that recommends itself to both student and practitioner for its promising orientation on essential fundamentals associated with the use and interpretation of ultrasonics in medicine. Volume II is actually the summing up of 33 papers within the scope of 15 chapters in concise but comprehensive form, in order to present at the earliest period its important data to the widest circle of interested readers. Its merit is demonstrated by its increasing popularity

abroad, for it not only reduces the tedious wait for published articles in scattered journals but has the virtue of offering the sectional transaction within the pages of a single volume. Each chapter under the pen of a recognized authority therefore offers in compact form an amazing amount of information. To mention a few, Pohlman reviews the question of the radiation effect of the ultrasonic field in relation to dosages. Justus Lehmann recently of the University of Frankfurt and now of the Mayo Clinic, contributes three chapters (1) on the recent advances of the fundamental biophysical effects of ultrasonic therapy, (2) on the effect of ultrasonics on the formative elements of the blood, and (3) on the nature and effect of impulse sounding in ultrasonic therapy. Lehmann, in his studies, rightly insists that the thermic factor is a role not to be denied, but others with equal authority insist that ultrasonic energy is not diathermy but an energy which releases physical and thermo-dynamic forces of an identity independent of heat alone. The 678 references up to January, 1950, of the progress of ultrasonics in physics, biology and medicine is a tribute to the scholarly cooperation of Professor L. Bergmann and recalls his own text of over 1100 pages as the classic in its field.

Volume III deals with the many problems of dosage measurement and its techniques and has become one of the most sought after texts on the practical and theoretic understanding of this important facet of ultrasonic therapy. It virtually reviews all the techniques and variable approaches as part of the dosage problem in therapy. In its fifteen chapters it brings the importance of the subject into clear focus by many original expositions by a selected group of representative authors. Indeed it is difficult to conceive how one could enter this field of ultrasonic therapy without the clear orientation this small monograph offers through the guidance and opinions of such reputable names as Waldick, Keller, Barth, J. Lehmann, Buchtala, Wegner, Koeppen and others. The text is in the best tradition of German workmanship, including a representative bibliography. These three monographs convey an illuminating impression of the present status of ultrasonic therapy through an authoritative evaluation of its highly promising future in the field of medicine.

MASS CARE IN DISASTER. ARC 1540. Paper. Pp. 107, with illustrations. American National Red Cross, 17th and D St., N. W., Washington, D. C., 1951.

This booklet contains an extraordinary amount of detailed information for use by those who undertake to give organized assistance to victims of disaster. The instructive opening section describes the complexities of the necessary organization, including the relation of other agencies to the local chapters. This is followed by a section confusingly headed "The Chapters," namely, chapters on food, on clothing, on shelters, on medical and nursing services, and on civil defense. These chapters contain valuable check-lists of supplies that may be needed and duties to be performed, and they are supplemented by extensive appendixes dealing mainly with problems of mass feeding. Appendixes E (Food Purchase Guide) and I (Suggested Recipes for Mass Feeding) are especially good. Rather hard to decipher is Appendix P, which features three baffling sketches, abbreviates unfamiliar words that ought by all means to be spelled out, and uses the deprecated symbol # in three different senses. Appendix S is a "disaster application card" the significance of which is not immediately clear. These points are mentioned because clarity seems especially desirable in books to be consulted in emergencies. As a whole, this booklet deserves high praise for the constructive, humanitarian effort it represents. A wide reading would bring to many people a better understanding of this aspect of the work of the Red Cross.

RECENT ADVANCES IN MEDICINE. By *G. E. Beaumont*, M.A., D.M. (Oxon.), F.R.C.P., D.P.H. (Lond.), Physician to the Middlesex Hospital; Physician to the Hospital for Consumption and Diseases of the Chest, Brompton; Lecturer in Medicine, Middlesex Hospital Medical School; and *E. C. Dodds*, M.V.O., D.Sc., Ph.D., M.D., F.R.C.P., F.R.I.C., F.R.S. (Edin.), F.R.S., Professor of Biochemistry in the University of London; Director of Cautauld Institute of Biochemistry, Middlesex Hospital. Twelfth Edition. Cloth. Price, $6.00. Pp. 422, with 42 illustrations. The Blakiston Company, 1012 Walnut Street, Philadelphia 5, 1947.

This book, Recent Advances in Medicine, was compiled by the authors, first, to assist physicians who have lacked the opportunity for graduate study, to familiarize themselves with some of the notable advances in medicine; second, to provide a reference book for those preparing for the specialty boards, and third, to include recent chemical methods so as to be of assistance to the laboratory worker, thus forming a link between the hospital wards and the laboratory. Naturally, it is most difficult to decide the actual scope of the contents, but the authors have apparently used unusual talent and discretion. This is the twelfth edition of the work, which would seem to indicate its usefulness.

This edition has been thoroughly revised and about one hundred pages of new material added. In chapter one, entitled chemotherapy, the mode of action of the sulfonamide drugs has been rewritten and a new section added on synthetic anti-malarial drugs. The penicillin chapter is new and is discussed both from the laboratory and the clinical aspects; in addition an article on streptomycin, streptothricin, and tyrothricin is also added. Marked alterations have been made in the chapter on vitamins. New articles appearing include those dealing with thiouracil, primary atypical pneumonia, infective hepatitis, homologous serum jaundice, bone marrow transfusion, and the use of thiocyanates in the treatment of high blood pressure. The work is divided into fourteen chapters. Each chapter closes with a well chosen list of references. The book is well written and well illustrated.

NEW CONCEPTS OF HYPNOSIS AS AN ADJUNCT TO PSYCHOTHERAPY AND MEDICINE. By *Bernard C. Gindes,* M.D. Introduction by *Dr. Robert M. Lindner.* Cloth. Price, $4.00. Pp. 262. Julian Press, Inc., division of Julian Messner, Inc., 8 W. 400th St., New York 18, 1951.

This attractively bound and unctuously written book promises more than one new idea about hypnotism. Most of the material in it, however, is a repetition of old and equivocal concepts, and some of it will mislead readers who are not accustomed to making fine distinctions. On page 187, for instance, is a mention of "newer therapeutic methods," consisting of Medium Sleep, vibratory passes, and touchings of the eyelids, used to relax the eye-muscles and improve eye-sight; these are said to be good for "ocular difficulties" but not for "ocular involvement."

A complete review is said to include some statement as to the qualification of the author. On this point it can only be remarked that the title-page does not indicate either the institutional connections or the present whereabouts of the author, and that there is doubt as to the source from which he may have obtained the title of "M.D." claimed for him on both dust-cover and title-page.

This book is not recommended.

THE NEW WAY TO BETTER HEARING RE-EDUCATION. By *Victor L. Brown,* M.D. Cloth. Price, $3.00. Crown Publishers, Dept. H-K. 419 4th Ave., New York 6, 1951.

This volume is prepared by a physician who has had experience in the rehabilitation of the hard of hearing. The important contribution offered in the book is on instructions for making audiometric examinations.

The author believes that his method of hearing reeducation, involving no surgery, hearing aids, drugs or medications, is a step forward. He claims that only a few minutes each day at home are required. In his opinion the method is for all people with defective hearing, whether or not they wear hearing aids. The author gives examples of methods by which the hearing can be improved, especially from the standpoint of intelligibility. Practice sessions are described. He uses a large number of practice words and sentences, exercises for "the freeing and converting of hidden hearing power," by "five private lessons per week" and "continuous reeducation throughout the day." He attempts to train the hard of hearing to be more attentive. Some case histories are mentioned to substantiate the value of his method of treatment.

It is doubtful that specialists in the field of audiology will agree with the author's explanation of how we hear. The author writes that the middle ear is like an amplifying instrument which "increases the force of strong sound waves as well as that of faint ones." The author's analogies occasionally lead him astray, as for example: "The middle ear apparatus is hooked into the inner ear in much the same fashion that a second locomotive is hooked onto a train, and for much the same purpose — greater power." The middle ear is claimed to be "nothing more than an amplifier." It picks up sound waves, increases their intensity, and delivers them to the oval window. Since there are already several theories of the process by which the human ear hears, and they do not agree among themselves, there is probably no objection to the presentation of another one. There are charts, graphs and other instructive material presented for assisting teachers to give instruction to the hard of hearing.

Parts of the volume are highly instructive, but some of the author's technical explanations are to say the least, unusual.

THE DISABLED IN THE MODERN WORLD. Proceedings of the Fifth World Congress of the International Society for the Welfare of Cripples Held at Stockholm, September 9-14, 1951 with the Co-operation of the Swedish Central Committee for the Care of Cripples. Clothbound, $3.50. Paperbound, $3.00. Pp. 279. International Society for the Welfare of Cripples, 127 East 52nd Street, New York 22, 1951.

The published proceedings of the Fifth World Congress since 1924 bring together the thinking of outstanding individuals of the world on the subject we loosely call medical rehabilitation. The subject matter discussed includes essentially all the major pathological conditions leading to physical handicaps. The various conditions are also considered from the point of view of the physician and surgeon, physical and occupational therapist, social worker, vocational tester and counsellor, and industrial employer.

This compilation should be available to all interested in the problem of planning and providing better facilities to care for individuals needing medical rehabilitation. Although technical details of therapy are not entirely lacking, those in the top level of planning and administration will find this of more value than will the therapist dealing with an individual patient.

POST-GRADUATE LECTURES ON ORTHOPEDIC DIAGNOSIS AND INDICATIONS. By *Arthur Steindler,* M.D., F.A.C.S., Professor of Orthopedic Surgery, State University of Iowa, Iowa City, Iowa. Volume III. Cloth. Price, $8.75. Pp. 284, with illustrations. Charles C Thomas, Publisher, 301-327 East Lawrence Ave., Springfield, Ill., 1952.

Doctor Steindler of the University of Iowa is not only a great orthopedic surgeon but also an unusual teacher; therefore, it is always a great privilege to receive writings dictated from his many years of rich experience both in the clinic and on the lecture platform.

This is the third volume of postgraduate lectures on orthopedic diagnosis and indications. It is a worthy successor to the former volumes and should find just as warm a welcome. The book is divided into two sections: Section A deals with the subject of tuberculosis of the skeletal system; section B is concerned with the subject of osteomyelitis. In section A there are six lectures as follows: Lecture one on tuberculosis of the

skeletal system: general; lecture two on tuberculosis of the spine (Pott's disease — spondylitis tuberculosa); lecture three on tuberculosis of the hip joints; lecture four on tuberculosis of the knee; lecture five on tuberculosis of the foot and ankle; and lecture six on tuberculosis of the upper extremity. In section B there are also six lectures: Lecture one on the pathogenesis and pathology of osteomyelitis; lecture two on the clinical pathology of osteomyelitis; lecture three on the treatment of osteomyelitis — acute and chronic; lecture four on osteomyelitis of the spine; lecture five on osteomyelitis of the pelvis; and lecture six on the more unusual types of osteomyelitis such as typhoid osteomyelitis, malta fever osteomyelitis, salmonella osteomyelitis, smallpox osteomyelitis, echinococcus infection of bone and the madduromycosis of bone.

These postgraduate lectures are all well planned, comprehensive, logically presented and written in easy understandable English. The lectures mostly follow a general plan of subdivision which is most helpful. Photographic illustrations have been amply supplied. The majority of the lectures culminate with an excellent summary of the subject matter. A reference list closes each lecture. In addition there is an adequate subject and author index.

The author does not discuss the role of physical therapy treatment. However, under the heading of constitutional therapy he gives ample attention to diet, vitamins, climatotherapy, and heliotherapy. He warns, however, that heliotherapy while of undoubted value must not be relied upon alone or considered adequate to cure surgical tuberculosis. Dr. Steindler states that it is necessary to warn against the indiscriminate and injudicious practice of heliotherapy in these patients. In some patients it is definitely contraindicated according to the author. Steindler has preference for the Rollier technique of exposure. It would seem unfortunate that the writer gives no consideration to artificial sources. Therapeutic sunlight in certain sections of the United States is so erratic both in quantity and quality of radiation. Physiatrists will find this volume most useful inasmuch as Steindler very carefully states just when and under what conditions weight bearing should be started. Hyperpyrexia is also mentioned as one form of treatment for osteomyelitis brucellosis.

This book must also be a matter of great pride to Charles C Thomas the publisher for it is a splendid tribute to his art. Both publisher and author are to be congratulated. The book is highly recommended.

ESSENTIALS OF HISTOLOGY. By *Margaret M. Hoskins*, Ph.D., and *Gerritt Bevelander*, Ph.D., New York University. Second edition. Cloth. Price, $4.00. Pp. 240, with 135 text illustrations and 2 color plates. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1952.

This compact book will appeal to many students, and will probably serve their needs if they have a good teacher and laboratory facilities. The small size is achieved by the omission of much material of an introductory, fundamental, historical and controversial nature, as well as details of laboratory procedure. What is retained will be regarded by many students gratefully as the irreducible minimum of technical information, especially convenient for reviewing. This information is simply and accurately set forth.

The book does not, however, represent a substantial advance either scientifically or pedagogically over what was current twenty-five years ago. There is little reference to the remarkable developments of recent years, such as the results of phase microscopy, microincineration and radioautography. The illustrations are generally labeled with abbreviations which the student is to decipher by referring to the fine print of the legends. The eye-strain and annoyance is increased by the fact that sometimes (e. g., page 166) these abbreviations are not in any discernible order. Eponymic phrases like "Bowman's capsule" are still in evidence, and the stupid nomenclature of hematology is where it was a quarter of a century ago. The discussion about the monophyletic theory which bored medical students at that time continues (page 80) to occupy hematologists.

The book is attractively printed and bound, and though it lacks a bibliography it has a good index.

TEXT-BOOK OF ORTHOPAEDIC MEDICINE. Volume II. TREATMENT BY MANIPULATION AND DEEP MASSAGE. By *James Cyriax*, M.D., B.Ch. (Cantab.), Physician to the Department of Physical Medicine, St. Thomas Hospital, London. Cloth. Price, $6.00. Pp. 335, with illustrations. Fourth edition. Paul B. Hoeber, Inc., Medical Book Dept. of Harper & Brothers, 49 East 33rd Street, New York 16, 1951.

The author explains that this new fourth edition of this title is an amplification of previous editions and forms Volume II of a new work to be entitled "A Text-Book of Orthopedic Medicine." This present book is directed to the physical therapist to explain the technical aspects of massage and manipulation or passive exercise.

The text is well illustrated, particularly showing points for specific finger pressure in a variety of connective tissue disorders where the therapists may be asked to apply massage. There is a brief summary of indications, warnings, and other details of technique on the page facing each illustration. Statements are all quite positive and might be confusing to students in American schools less subject to didactic statements as to the indications and benefits of massage. The technical information as to details of massage for the conditions described is valuable and not available elsewhere. All instructors of physical therapists should welcome this as source material and as a reference text for students.

The physiatrist should also consider this an essential part of his library. Some of the illustrative material indicates that the physician himself gives the treatment, in particular, the traction and manipulations; in this country we would recommend that this be merely the accepted practice.

As a physician, one may question some of the

indications for therapy described, but, since the book is directed toward therapists, no detailed discussion of indication of prescription or differential diagnosis is necessary, and this criticism may be avoided.

The section on varicose ulcers seems misplaced and unnecessary.

The publishers are to be congratulated on the excellence of this work.

A TRANSLATION OF GALEN'S HYGIENE (De Sanitate Tuenda). By *Robert Montraville Green*, M.D., Emeritus Professor of Anatomy, Harvard Medical School, Boston, Massachusetts. With an Introduction by *Henry E. Sigerist*, M.D. Fabrikoid. Price, $5.75. Pp. 277. Charles C Thomas, Publisher, 301-327 East Lawrence Avenue, Springfield, Ill., 1951.

This is the first translation of Galen's De Sanitate Tuenda into any modern language. Few of Galen's works are available in modern translations. This present translation was undertaken at the suggestion of Dr. Sidney Licht, and was made primarily from Kuhn's edition of the Greek text.

In the light of subsequently acquired knowledge much that Galen wrote is inaccurate. Yet his thinking was fundamentally sound. Some of his ideas are positively modern and show startling anticipation of future discovery. Galen was a very able physician who has a great deal to say and he had a keen understanding of the patient's psychology.

Galen was a great admirer of Hippocrates and from him borrowed the concept of the four cardinal humors that constitute the human body, blood, phlegm, yellow bile and black bile, and also the concept of elementary qualities, hot, cold, dry, moist, which occur in the body in a number of combinations and degrees. Galen shows that the hygienist's goal is to maintain the normal equilibrium of humors and qualities by prescribing the correct kind and amount of food, drink, sleep, wakefulness, sex activity, exercise, massage, and similar matters. It is startling to find how well he appreciated the variations of the norm in different individuals. Here, his concept is quite modern.

Galen also realized that not only health educators but that gymnast and masseur played an important part in the practice of hygiene. He states that while the trainer knows all the movements made in the gymnasium, he is ignorant of what each movement can accomplish, but the gymnast will not be ignorant of its effect. To over exercise, as some trainers compel boys to do, is not good, for he states that growth of the body may thus be prevented, even if it has the usual interval impulse for growth.

The history of medicine rarely, if ever, finds a place in medical education and this is most unfortunate. We can learn much from the past; thus everyone in the field of medicine owes a great debt to Doctor Green for this excellent translation of Galen's De Sanitate Tuenda. Gratitude of the medical profession should also be extended to the Julia Lecht Fund, which commissioned the translation. Charles C Thomas, as usual, has presented a work worthy of the publishing art.

This is a fascinating work and should be in the library of every physician. No physiatrist can afford to be without this classic. This is the kind of book which, once reading is started, one finds it difficult to lay aside.

Dr. Henry Sigerist formerly of Johns Hopkins University writes a splendid introduction and Dr. Sidney Licht gives an unusually fine translation from Daniel Le Clerc's Histoire de la Medicine on the life of Claudius Galen. This book is highly recommended.

THE HENRY L. JAFFE ANNIVERSARY NUMBER OF THE BULLETIN OF THE HOSPITAL FOR JOINT DISEASE. By *Samuel Kleinberg*, M.D., Editor-in-Chief, with 55 contributors of 35 original articles. Vol. 12, No. 2, October, 1951. Paper. Price, $6.00. Illustrated. The Waverly Press, Inc., Mt. Royal and Guilford Aves., Baltimore 2, 1951.

This impressive volume is an anniversary number dedicated as a tribute to Dr. Henry L. Jaffe, whose eminence as a pathologist has been recognized beyond the borders of our country, because of his original contributions during the past 25 years of service in the domain of his specialty. In science or medicine it is a bit of a novelty to see one honored for distinguished service at an age far below the period when it is customary to be revered for one's past labors. Henry L. Jaffe has earned this distinction because of his brilliance in research. So notable is his intellectual honesty and communicable enthusiasm as to capture the respect and affection of his distinguished colleagues. There is a friendly nuance presiding over this volume which invests it with a personal warmth foreign to the tone in most of the literature on bone and joint diseases. Jaffe's identification for the past 25 years as chief pathologist of the New York Hospital for Bone and Joint Diseases is also a tribute to the cooperative spirit of modern medicine with its opportunities for research, discovery and recognition.

The first essay is an autobiographic sketch of Dr. Jaffe and his fundamental contributions; his reputation is associated with (1) his investigation of the pathologic physsiology of the adrenal cortex and the later isolation by others of the adrenocortical hormone; (2) his studies of the development, structure, growth and the pathophysiologic reactions of the skeletal tissues; and (3) his studies in the past ten years of specific skeletal diseases, a period in which he is also credited with 125 contributions and a forthcoming monograph and textbook. The content of this volume includes 35 original studies by 55 distinguished colleagues, centralized on as many problems associated with bone and joint abnormalities. The listed names of these contributors seem to stem from the top echelon of "Who's Who" in the field of bone and joint disorders and thus assures the most authoritative expression on the topics under consideration. To this the ARCHIVES adds its heartiest felicitations.

MODERN TRENDS IN PHYSIOLOGY AND BIOCHEMISTRY. WOODS HOLE LECTURES DEDICATED TO THE MEMORY OF LEONOR MICHAELIS. Edited by *E. S. Guzman Barron*, Chemical Division, Department of Medicine, The University of Chicago. Cloth. Price, $8.50. Pp. 538 with illustrations. Academic Press, Inc., 125 East 23rd Street, New York 10, 1952.

This valuable book contains some of the lectures of the Department of Physiology of the Marine Biological Laboratory given in the 1950 course in physiology. The 1950 course was to have been dedicated to commemorate the seventy-fifth birthday of Professor Leonor Michaelis but unfortunately, his death converted the celebration into a memorial tribute.

The physiology course of the Marine Biological Laboratory was started in 1898 by Jacques Loeb, who brought to it his fundamental philosophic principles and scientific method, and although the teaching staff has changed many times its guiding principles have been retained. Michaelis, with Loeb, pioneered in the physical and chemical phenomena which in their integration make up the vital life processes. These two great scientists introduced into biology the now well-known physico-chemical methods. This approach, sometimes called molecular biology, has always been the aim of the Woods Hole staff.

There are twenty chapters in this book and each is written by a leading scientist in the subject matter under discussion. The subjects discussed may be arranged in six groups: 1. The physiology of the cell is treated in five chapters; 2. the properties of muscle are treated in three chapters. New methods for the purification of some of the protein components of muscle are presented, the application of thermodynamic principles of muscle contraction, and the transport of material across the muscle and nerve membranes; 3. nerve physiology is dealt with in five chapters; 4. some aspects of the energy necessary for the performance of vital activities as produced by enzyme reactions are discussed in five chapters; 5. the study of the action of foreign agents such as drugs being also the domain of physiology, a chapter on the mechanism of drug action is included; 6. a special chapter is devoted to a discussion of the best known examples of biochemical evolution.

While this authoritative work under the able editorship of Professor Barron of the University of Chicago may not interest the rank and file of physiatrists, it should prove to be of marked value to those who are actively engaged in research or have an active interest in physiology. The sections on nerve and muscle physiology should prove particularly interesting. Each chapter closes with a well selected list of references for further study. The book contains an excellent subject and author index. This volume is highly recommended for those who have an interest in molecular biology.

PRINCIPLES AND PRACTICE OF AVIATION MEDICINE. By *Harry G. Armstrong*, M.D., F.A.C.P., The Surgeon General, U. S. Air Force. Third edition. Cloth. Price, $7.50. Pp. 488, with 97 illustrations. The Williams & Wilkins Company, Mt. Royal and Guilford Aves., Baltimore 2, 1952.

This important volume begins with two absorbing chapters on the history of aviation medicine, continues with problems of pilot selection, with the physiology and pathology of high altitudes, with the effects of noise, decompression, and acceleration, with accidents and emotional reactions, and with problems of air rescue and evacuation, and closes with a discussion of hygienic, sanitary, and protective measures.

Somewhat unsettling the reader's confidence in the book are a multitude of small defects surprising in a third edition. These include the persistent misspelling of "pruritus" (pages 136, 312), careless mathematics (proof that 760 — 47 = 103, page 195), inaccurate definitions (353), baffling abbreviations (433), unexplained recommendations (sage green as the color for tinted lenses, 450), and misuse of the diopter as a measure of curvature (450). More serious is the retention of a mode of thinking implied in the phrase "stigmata of degeneration" (142). The unscientific basis and the vicious implications of this phrase have been brought repeatedly to the attention of the medical world, and it should no longer be mentioned but to be condemned, yet it continues to pass along from one generation of writers to another, so that the index of a recent German book actually lists 2½ columns of entries under the heading "Abartungszeichen." Since these include an extraordinary range of insignificant variations, from webbed toes to misplaced teeth, plus such ill-defined peculiarities as multiple naevi and anomalous color vision, a literal following of this line of thinking takes one straight back to the "Malleus Maleficarum" and reduces physical examinations to the level of witch-hunting. It is earnestly to be hoped that this will be corrected in future editions, especially since a book as important as this one is read with great literalness by students.

On the whole, it is inclusive, practical, and interesting: It is provided with illustrations, bibliographies, and an index, and is attractively bound.

MULTIPLE SCLEROSIS: APPLICATION OF REHABILITATION TECHNIQUES. By *Edward E. Gordon*, M.D. Paper. Pp. 54, with 54 illustrations. National Multiple Sclerosis Society, 270 Park Ave., New York 17, 1951.

This pamphlet outlines a comprehensive program for the care of patients with multiple sclerosis. It is excellent and should be valuable to all personnel in physical medicine. It is furnished without charge.

PHYSICAL MEDICINE ABSTRACTS

The Present Obligation of Physical Medicne and Rehabilitation. George Morris Piersol.

J. A. M. A. **147**:1093 (Nov. 17) 1951.

It is only within the recent past that the field of physical medicine and rehabilitation has been given long overdue recognition as an accredited medical specialty. Such recognition, gratifying as it is, carries with it increased responsibilities and definite obligations. The obligations which physical medicine must meet fall into two categories: (1) those of immediate concern, the result of present circumstances, and (2) long range obligations which have developed insidiously, are of indefinite duration, and continuously tax us. The obligations of physical medicine are not limited to the circumstances that have grown out of what we hope is a temporary situation. As the life expectancy in the United States is increased, and more people survive to old age, the greater becomes the incidence in our population of chronic degenerative diseases. Since physical medicine, as presently understood, offers the most rational approach to the management of this group of individuals, physiatrists will be called upon more and more to care for the chronically ill. The obligations of physical medicine arising from the care of our civilian population are not limited to the treatment and reeducation of the chronically ill. To that load must be added the stupendous number of those injured in accidents that annually place such a huge medical and economic burden upon our nation. It is generally admitted that the civilian needs for physical therapists and physicians qualified in physical medicine far exceed those of the governmental agencies. The solution of this problem may be stated in the single word "education." Broadly considered, the word implies arousing among physicians, students of medicine, and the public an interest in, and appreciation of, the requirements and potentialities of broad, well integrated reconditioning programs. Certification in physical medicine, as in every other specialty, is becoming more and more a necessity as governmental and private agencies continue to insist upon it as a prerequisite to responsible professional positions. If the number of physicians who become certified each year does not show a prompt and considerable increase, it will be a long time before we can hope to meet the demand for certified physiatrists. The first remedial step is to expand in our undergraduate medical schools the teaching of physical medicine. In order that education in physical medicine should continue, a tour of duty in that department should be made a part of the training program of every intern. More familiarity with physical medicine will encourage interns to seek residencies in this field. An effort has been made in this education to indicate some of the obligations which face physical medicine. The underlying problems involved are many and complicated. Their solution is difficult and will require time, wisdom, and well directed effort. The record of our past accomplishments leaves no doubt but that the present and future obligations of physical medicine will be met successfully.

Physical Treatment and Rehabilitation of the Hemiplegic Patient in General Practice. Odon F. von Werssowetz.

Am. Pract. **2**:963 (Nov.) 1951.

In an average case of hemiplegia, because of the long duration of treatment, it is not practical to have the patient hospitalized or brought to a clinic several times a day for treatment by skilled therapists. Neither is it practicable to have a physical therapist visit the patient in his home as often as treatment is indicated. Obviously, the physician himself cannot undertake the actual administration of a retraining program but should delegate it to a member of the family who can conduct the activities under his supervision. With a program of this kind, many of the complications usually associated with hemiplegia can be avoided. If the treatment is started early, limitation of motion can be prevented in the affected extremities. If, however, the patient is not treated early, contractures usually occur first in the shoulder and foot and later in all joints. The over-all aims of physical treatment and rehabilitation in general are: To prevent and correct deformities; to improve muscle function, and to increase functional capacity by: (a) retraining the patient in ambulation; (b) reestablishing the function in the affected upper extremity as far as possible, and teaching the patient to perform activities essential to daily living with the unaffected upper limb; and (c) training in speech, if such disability is present.

In recent cases of hemiplegia, maintenance of the proper bed position is all that may be required to prevent deformities. There may be no need for any special procedures to protect the affected limbs, though a support for the bed clothes — to keep them off the foot — is advisable. Gentle passive movements, through the full range of each joint, should be administered at least twice daily, for adhesions begin to form very early in the first week. When formed, they are difficult to remove. Gentle movements may be administered through the use of pulleys. Pulley therapy, when administered by the patient, has the advantage over the usual stretching exercises that are done passively, for the patient, knowing his own pain threshold, will proceed to full tolerated motion much more quickly. Pulley therapy also can be used to aid in the reestablishment of reciprocal motion patterns. Quadriceps setting exercises should be started early, as this muscle is one of the first to

show atrophy and is one of the important muscles in ambulation. An excellent exercise for the patient with a paralyzed and stiffening arm is to interlace the fingers with those of his other hand and then, helping the paralyzed by the sound limb, to imitate the movement of rowing with both. Thus the contracted fingers are straightened, the wrist and triceps extended, and the biceps relaxed in one procedure. Passive movements of the arm in abduction external rotation and in the overhead position should be performed several times a day to prevent a frozen shoulder.

Peripheral Vascular Diseases: Conservative Medical Management. Howard E. Heyer.

Texas State J. Med. **48**:7 (Jan.) 1952.

The complete elimination of the use of tobacco is a prime essential in the therapy of Buerger's disease. The degree of physical activity should be reduced to a level below that known to cause discomfort. This may necessitate absolute bed rest if pain is severe. If any ulceration or inflammation, even of slight degree, is present, antibiotic therapy, preferably parenteral penicillin, should be given. In addition to medical treatment, physical therapy frequently will be of considerable help in restoring normal circulation. Buerger's exercises, if performed regularly, will help many patients with this disorder. However, as a practical matter, it has been found difficult to be certain that patients will follow such laborious exercises during a long period. A much more helpful measure is the use of a motor driven oscillating bed which, by its cradle-like action, allows alternate dependency and elevation of the lower limbs. This, in effect, is a lazy man's type of Buerger's exercises, which may be performed, with benefit, for periods varying from eight to twenty-four hours per day. Heyer feels that this is the most efficient type of physical therapy that is available in the treatment of occlusive vascular diseases of the extremities. Alternate hot and cold immersion baths are harmful, if the temperature of the water is either too hot or too cold, respectively. For this reason, Heyer has discontinued their use.

Local Cold Injury — Frostbite. R. B. Lewis.

Mil. Surgeon **110**:25 (Jan.) 1952.

The best evidence indicates that frostbite injures tissues by acting directly upon the cells. It appears that the vascular changes which have been described following frostbite are of secondary importance, and it remains to be proved whether they have an effect on the outcome of frostbitten tissue. The only therapeutic measure which has been universally successful with investigators has been that of rapid rewarming of frostbitten tissue. Therapeutic procedures which have attacked the vascular system have given inconsistent results in the hands of various investigators. It appears that, in the light of present knowledge, little benefit will be gained by treating frostbite after the tissue has been brought to body temperature. Evidence indicates that the damage is done at the time of the cold injury and that the ultimate injury is primarily the function of three factors: (1) the exposure temperature; (2) the time of exposure, and (3) the medium conducting the heat from the part which is generally either water, air, or metal.

Rehabilitation in Institutional Geriatrics: A Preliminary Report. Leo Dobrin.

New York State J. Med. **52**:81 (Jan. 1) 1952.

The medical, social, and economic problems presented by our aging population are receiving increasing attention on national and local planning levels, but to the average professional worker in the field of physical medicine and rehabilitation, geriatric rehabilitation is, at best, "something to think about" or, at worst, "hardly worthwhile." There are now twelve million people over sixty-five years of age in this country. The application of the principles and techniques of rehabilitation to a group of 67 men and women averaging 76.6 years of age, residents of a modern home for the aged, is described in this article. These methods make possible the restoration to normal activity of elderly individuals suffering from the results of cerebrovascular accidents, of various types of arthritis, of ununited hip fractures, of amputations, and of a variety of life-long disabilities. Physical rehabilitation thus makes a great positive contribution to the physical and mental health of the aged by actively combatting what were once regarded as hopeless and progressive infirmities. The Department of Physical Medicine and Rehabilitation has taken its place with the other services and activities of the institution which are designed to make life significant and worthwhile for the residents, regardless of chronologic age.

Physical Medicine for the Neurologic Patient. Arthur L. Watkins.

New York State J. Med. **52**:315 (Feb. 1) 1952.

The specialists of neurology and physical medicine and rehabilitation have much in common, since the diagnosis and treatment of neuromuscular disorders represent a large proportion of the practice in both fields.

To illustrate the principles employed in physical medicine for the treatment of peripheral nerve lesions, Watkins discusses facial paralysis or Bell's palsy. Electrical tests are performed a week to ten days after the onset, in order to determine the severity of the lesion. The prescription for physical therapy considers first the necessity for splinting to prevent excessive stretching of paralyzed muscle. This is not always necessary in the case of facial paralysis, protection of a sagging eyelid being of prime importance.

Most patients derive some symptomatic comfort from application of warm, moist towels to the face or irradiation with an infrared lamp for fifteen to twenty minutes. This usually is followed by gentle stroking massage, at first from the corner of the mouth toward the eye; later, when there is some active function, massage may be in the opposite direction to stretch contractures.

The benefits of electrical stimulation are of two varieties. During the paralytic stage, obtaining contractions of the muscles is of great psychologic value in many patients. At this stage of paralysis, passive exercises are useful to maintain proper length of muscles; this is particularly true in the case of muscles of the extremities, where joint motion also must be maintained. As reinnervation occurs the patient should be instructed in active reeducation, which is best done in front of the mirror.

Electrical tests are useful for purposes of prognosis; a recent study indicated that all patients with normal response had complete recovery. Although these same principles of treatment are utilized in the care of patients with peripheral nerve injuries of the extremities, peripheral neuritis, and poliomyelitis, there are other methods of treatment of special value, such as progressive resistance exercises to hasten improvement in muscle strength.

The patient with hemiplegia gives us a typical example of an upper motor neuron disorder with its components of motor and sensory disability. As soon as the medical measures necessary to save life have been instituted, physical medicine may be prescribed. Positioning in bed to prevent footdrop and external rotation is the first consideration. Gentle passive exercise may be started as soon as it is evident that the patient will survive.

When the general condition permits, the physical therapist should attempt active reeducation of any functioning muscle groups. One generally starts with gross movements of the hip, shoulder, knee, and elbow, as these motions return before the function of the distal portion of the extremities. During the early, more flaccid stage, one may wish to stimulate the stretch reflex by passive motion in order to bring contraction of the muscles. As soon as spasticity is well established, any forceful or sudden passive motion which stimulates the stretch reflex should be avoided, as it then interferes with voluntary control of movement.

Massage has been found to be of limited value. During the period of complete paralysis it may be used for tonic effect on the circulation. Later, with returning power and increasing spasticity, it is to be avoided unless very skillfully given, since it may overstimulate reflexes. This is particularly true of mechanical vibratory devices.

The importance of using electrical stimulation is open to some question. However, mechanical aids should not be overlooked; for example, a shoulder pulley placed under the patient's own control is an excellent way of maintaining motion of this joint.

Osteoarthritis of the Hip: Its Surgical Treatment. Walter Mercer.

Edinburgh M. J. **58**:521 (Nov.) 1951.

Osteoarthritis is nowadays one of the commonest and, at the same time, most neglected of our diseases. Its neglect is not justified, for there are few people suffering from this crippling and painful condition who cannot be relieved. In treating a patient with osteoarthritis of the hip, it is necessary before planning any course of treatment to consider all available information, not only about the local condition and its effects, but about the general make-up of the patient. The patient himself will require even more attention than the joint. It is necessary to consider in detail his age, physical condition, and economic state; his employment and its nature, and the necessity or otherwise of continuing with it. In the early stages much benefit can be derived from conservative measures. Bad posture from faulty weight-bearing is corrected, and appropriate foot and posture exercises are given in conjunction with treatment directed towards the hip itself. Working conditions are investigated and altered or modified where necessary. Where there is a flexion deformity a rest period every day in the prone position is insisted upon, or even traction for a period to relieve the muscular spasm and diminish the pain. Obesity is common and is corrected by a low calorie diet. For the local condition, short-wave therapy is useful in reinforcing the blood and lymph supply. It is given at maximum toleration daily. Massage also is wonderfully helpful. For the anterior part of the capsule to be reached the thigh is flexed, abducted and laterally rotated and deep friction applied transversely across the fibers of the capsule. The posterior part of the capsule is reached by deep pressure one and a half inches medial to the upper edge of the great trochanter. Exercises should be nonweight-bearing and designed to overcome the flexion deformity. The value of X-ray therapy in this deeply seated hip-joint is doubted. In many of the reasonably early cases much benefit may be obtained, both in cases of pain and of limited movement, by manipulation under anesthesia. The method is easy and the hip is only put through a full—or as full as possible—range of movement of flexion and extension Other movements are somewhat dangerous and are better avoided. The improvement obviously must be temporary and the treatment palliative, for, of course, the symptoms recur, but the improvement may last two to three years. A second similar maneuver is rarely so successful or its effect so lasting. The success of arthroplasty depends among other things upon very cooperative patients and intense postoperative care. Some method of retaining internal rotation, either by rotational skin traction or a plaster boot with a cross-piece of wood, is continued for three weeks and the patient may get up in six to eight weeks. He uses crutches at first. Physical therapy is initiated in the first week and is necessary as the hip-moving muscles often have been more or less out of action for a long time on account of pain and disease, and must be carefully reeducated by graduated exercises. Movements are helped greatly while in bed if a roller skate is fixed to the foot on the affected side and allowed to glide on a broad smooth board laid on the bed.

CHICAGO SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION

The first meeting of The Chicago Society of Physical Medicine and Rehabilitation for the 1952 - 53 season will be held on Wednesday, September 24, 1952 at the Stritch School of Medicine, Loyola University, 706 S. Wolcott Street, Chicago, 8:00 p. m. Dr. Y. T. Oester and Mr. Edward P. O'Malley will present the topic "Recent Experimental Studies in Iontophoresis."

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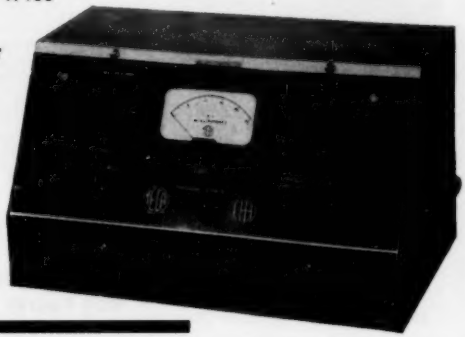

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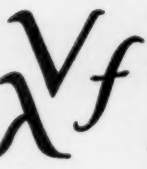

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